Lee Reid - ENGINEERING

Instruction Manual

E. S. D. INSTRUMENTATION
C.C. 203 MS 145
RM 22508 EXT 2224

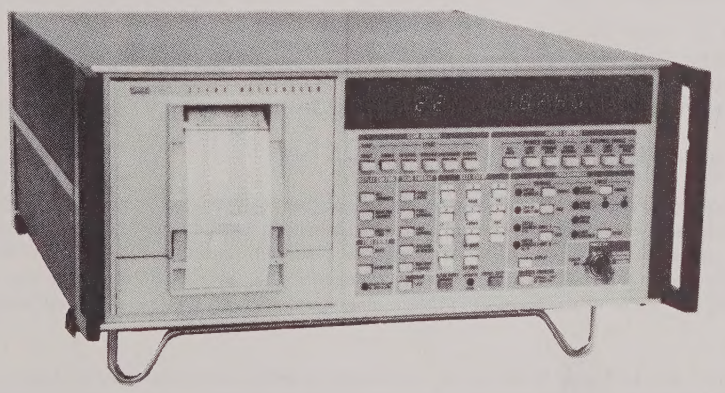
FLUKE®

JOHN FLUKE mfg. co., inc.
SEATTLE WASHINGTON

E.S.D. INSTRUMENTATION
C.C. 203 MS 135
RM 2250B EXT 2224

JOHN FLUKE MFG. CO., INC.

P. O. Box 43210
Mountlake Terrace, Washington 98043



MODEL

2240A

DATA LOGGER

P/N 427948

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Rev. 11/75

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Applicable NBS Test Reports:

DC Voltage – 213385

AC Voltage – 212126 & 807675

Resistance – 210508

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MODEL _____ SERIAL NUMBER _____ PURCHASE DATE _____

What influenced you to buy this Fluke product? ☐ Advertising ☐ Contact by local salesman ☐ Other (specify) _____

Have you had previous experience with Fluke instruments? ☐ Yes ☐ No

Did you buy this Fluke product to: ☐ Replace existing equipment ☐ Expand your instrumentation capability

Other (specify) _____

Did you examine comparable products manufactured by other companies before deciding on Fluke? ☐ Yes ☐ No

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Did it perform properly on initial operation? ☐ Yes ☐ No If no, what symptoms were present? _____

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	Poor	Adequate	Superior		Poor	Adequate	Superior
Performance	☐	☐	☐	Useability	☐	☐	☐
Reliability	☐	☐	☐	Serviceability	☐	☐	☐

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FORM NO. A773 - Rev. 2 - 2/75

CHANGE/ERRATA INFORMATION

MANUAL — TITLE: 2200A/2240A DATA LOGGER

ISSUE: ORIGINAL

Please make changes in this manual according to the following change and/or errata information:

ERRATA

In Section 6, page 612-2, paragraph 612-12, step d, change procedural steps 1, 2 and 4 to read as follows:

1. Set switches 0 through 23 to OFF. This establishes the recorded data format shown in Figure 612-2.

2. Delete any combination of unwanted character segments by setting the assigned switches to ON.

4. If a TTY is used to record data, set switches 12 through 15 to the desired number of readings per line (1 through 16). Total characters and spaces printed on a line cannot exceed the number of columns available on the TTY (80 typical).

On page 612-3, Figure 612-2, change the 4800 Baud Rate Code from 4800 = 1110 to 4800 = 0111.

In Section 6, page 613-3, paragraph 613-12, step d, change procedural steps 1 and 2 to read as follows:

1. Set switches 0 through 23 to OFF. This establishes the recorded data format shown in Figure 613-2.

2. Delete any combination of unwanted character segments by setting the assigned switches to ON.

In Section 6, page 614-3, paragraph 614-12, step d, change procedural steps 1 and 2 to read as follows:

1. Set switches 0 through 23 to OFF. This establishes the recorded data format shown in Figure 614-2.

2. Delete any combination of unwanted character segments by setting the assigned switches to ON.

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Section 1
Introduction & Specifications

1.1. INTRODUCTION

1-2. The Fluke Model 2240A Data Logger, in its basic form, is a processor and recorder which is expandable, through the use of optional plug-in modules, into a user-designed data acquisition system capable of servicing up to 1000 channels of guarded analog data. The basic unit is contained within a mechanical housing and consists of a front-mounted control panel, a digital display, a digital printer, a power supply, the control logic required to interface the basic unit with a full complement of options, and a series of pcb and module slots designed to accommodate a number of plug-in options. To form an operational data acquisition system, the 2240A must be equipped with at least one each of the three following options: a scanner (Option –05 or –06), a scanner input connector (Option –07 or –08), and an A/D Converter (Option –09 or –10).

1-3. The front panel of the 2240A features all of the controls necessary to operate the unit with a full complement of optional plug-ins. The controls consist primarily of push-button switches which are separated into 10 unique groups. Five groups perform control functions and five groups are dedicated to programming the 2240A. The control group includes: Power, OUTPUT CONTROL, PROGRAM LIST, SCAN CONTROL and DISPLAY CONTROL. The Program groups include: TIME ENTRY, SCAN FORMAT, PROGRAMMING (CHANNEL and LIMITS), ADVANCE ADDRESS and DATA ENTRY,

1-4. The 2240A is energized, and all switches in the control group are enabled when the power switch is set to either POWER ON or KEYBOARD PROGRAM DISABLE. Selected data processed by the 2240A can be recorded on the internal printer and/or external digital recording devices. Control of the recording devices and the selection of data is accomplished by the switches in the OUTPUT CONTROL group. Program data present in the 2240A can be solicited and recorded using the PROGRAM LIST and OUTPUT CONTROL switches. Four unique scan modes (single, interval, monitor and continuous) are available. and each can be started or stopped using the START/STOP switches in the SCAN CONTROL group. During a scan sequence, channel and measurement data is normally presented on the front-panel display. Alternate data (time of year or monitor channel) can be selected for display without interrupting the scan sequence by using the switches in the DISPLAY CONTROL group.

1-5. The programming switch groups are enabled when the power switch is set to POWER ON. Program data is manually entered via the DATA ENTRY keyboard and the specific kind of data to be entered is determined by selecting it from either the TIME ENTRY, SCAN FORMAT or PROGRAMMING (CHANNEL, LIMITS) switch groups. Time is entered in days, hours, minutes and seconds, and is easily synchronized to the true time-of-day. The scan format can be randomly programmed to define: 6 digits of fixed data., first and last channel in a scan sequence, time interval between the start of scan sequences when the interval scan control mode is initiated, and the single channel to be monitored when the monitor scan control mode is initiated. Channel programming switches enable unique measurement functions and measurement limits to be assigned to each channel in the scan format. If one or more channels in the scan format are not to be used, a skip function can be programmed. Limits programming (Options –21 and –22) switches enable up to 30 unique 5-digit limit values (including HI/LO sense and polarity) to be programmed. Each limit is assigned a unique address code from 1 to 30, and any one of the limit values assigned to codes 1 through 15 and/or 16 to 30 can be assigned to codes 1 through 15 and/or 16 to 30 can be assigned to any channel by entering the appropriate address codes while programming channel data.

1-6. The digital display is functionally two separate displays which are used for visually presenting the current mea-

surement channel three digits) and the current measurement data for that channel (polarity, plus five digits and a decimal point). During a normal scan sequence (first channel-to-last channel), the measurement channel is incrementally advanced as each channel measurement is completed, and continues to advance after each measurement until the last selected channel, (000 up to 999) is scanned. A series of annunciators complement the display and indicate the selected measurement function (volts, millivolts, temperature) for the channel indicated. The display is also used during the scan intervals to present the current time-of-year, and during programming sequences to display program data.

1-7. The printer employed in the 2240A is the Seiko Model 102. It is a medium-speed ink impression line printer capable of recording data at a maximum rate of 2.5 lines per second. Sixteen data columns are available, However, the print format for a scan sequence is fixed, as described in Section 2. Ordinary 2¼-inch fan-fold adding machine paper is used as the recording medium. A front-panel drawer is provided for both housing and take-up of the self-stacking fan-fold paper.

1-8. The power supply provided with the 2240A is capable of servicing both the basic unit and a full complement of options. Input power requirements are 100, 115 or 230V ac ±10%, 50 or 60 Hz, 50 watts maximum. The desired combination of line voltage and frequency should be specified at the time of purchase.

1-9. The control logic of the 2240A includes all of the circuitry necessary to accommodate a full complement of 2240A options. Two important features of the control logic are: the program memory and the guard crossing. The program memory is impervious to the line power interruption and can be maintained for several years after the 2240A is switched OFF. The memory is sustained by a set of lithium batteries which are switched into operation when the line power is removed. The guard-crossing circuit electrically isolates the operation of the scanner blocks (Option –05 or –06) and the analog portion of the measurement circuit (A/D Converter, Option –09 or –10) from the digital control and external equipment interface section of the 2240A.

1-10. Several Options and accessories are available for use with the 2240A. The options, their quantity limitations and their installation requirements (factory or field) are listed in Table 1-1. Table 1-2 provides a description of the sub options included in the –12, –13 and –14 series of options, and Table 1-3 describes the available 2240A Accessories. A detailed description of each option and major accessory, and instructions for their installation, operation and maintenance are given in Section 6, Option and Accessory Information.

Table 1-1. 2240A OPTION INFORMATION

OPTION	DESCRIPTION	QUANTITY LIMITATIONS		INSTALLATION [1]
		MIN	MAX	
–05	General Purpose Scanner	1	6	○
–06	Low Level Scanner			
–07	Solder Pin Connector	1	6	○
–08	Isothermal Block Connector			
–09	A/D Converter, General Purpose	1	1	●
–10	A/D Converter, High Performance			
–11	Temperature Measurement	0	1	●
See Table 1-2 for detailed description –12	Teleprinter/Cassette Interface Opts	0	3 I/O PCB's	○
–13	Paper Tape Punch Interface Options			
–14	Magnetic Tape Interface Options			
–16	Digital Input Options			
–20	Program Memory Expansion	0	1	●
–21	Seven Single-Limit Set Points	0	2	●
–22	Fifteen Signle-Limit Set Points			
–23	Alarm Output	0	1	○

[1] ● = FACTORY or SERVICE CENTER INSTALLATION
○ = USER CAN INSTALL

Table 1-2. DESCRIPTION OF –12, –13 and –14 SERIES OPTIONS

OPTION NO.	DESCRIPTION	RECORDER TYPE	* OPTION CONFIGURATION		
			RE-CORDER	CABLE	INTERFACE PCB
–12A	ASR33 (Pedestal) and Interface	Teleprinter	●	●	●
–12B	ASR33 Interface		O	●	●
–12C	TI733 KSR/RO Interface		O	●	●
–12D	RS-232-C General Purpose Interface		O	●	●
–12E	Techtran 8401 Cassette and Interface	Cassette	●	●	●
–12F	Techtran 8410 Cassette Recorder		●	O	O
–12G	Techtran 8400 Cassette Recorder		●	O	O
–12H	Techtran Cassette Recorder Interface		O	●	●
–12I	Techtran Input Power Adder; 230V ac, 50Hz		O	O	O
–12J	Techtran Cassette Rackmount Kit		O	O	O
–13A	Facit 4070 (Bench Top) and Interface	Paper Tape Punch	●	●	●
–13B	Facit 4070 (Rack mounted) and Interface		●	●	●
–13C	Facit 4070 Interface		O	●	●
–14A	Kennedy 1600/5 and Interface	Magnetic Tape	●	●	●
–14B	Kennedy 1610/5 and Interface		●	●	●
–14C	Kennedy 1600/360 and Interface		●	●	●
–14D	Kennedy 1610/360 and Interface		●	●	●
–14E	Kennedy 1600/5 or 1610/5 Interface		O	●	●
–14G	Kennedy 1600/360 or 1610/360 Interface		O	●	●
–14F	Custom Magnetic Tape Interface		O	●	●

* ● = INCLUDED
O = NOT INCLUDED

Table 1-3. 2240A ACCESSORIES

MODEL NO.	DESCRIPTION
2201A	Scanner Extender Chassis
2200A-7007	Interface Connector, Blank(50-pin)
2200A-7006	General Purpose Interface Cable
2200A-7005	PCB Extender Cable Set
MO7-205-600	Rack Mounting Kit
MOO-280-610	Rack Slide Kit, 24" Cabinet
2200A-7013	Fan-Fold Printer Paper (1 dozen)
2200A-7014	Printer Ribbon (1 dozen)

1-11. SPECIFICATIONS

1-12. Specifications for the Model 2240A Data Logger and its available options are contained in Table 1-3.

Table 1-4. SPECIFICATIONS

BASIC UNIT -2240A

Channel Capacity	60 channels, expandable to 1000 channels using the Model 2201A Scanner Extender Chassis.
Scanning Speed	
Option –09	3 channels/sec max.
Option –10	3 or 15 channels/sec max. (internally selec table)
Channel Display	3 digits.
Data Display	
Numeric	Polarity plus 5 digits
Annunciator	mV, V, temperature, date and time.
Scan Conrols	Push button switches initiate the following scan formations: SINGLE INTERVAL MONITOR CONTINUOUS REMOTE STOP/RESET
Output Controls	Push button switches control the operation of the Printer and/or external recorder. PRINTER ENABLE ALL DATA LIMIT DATA INTERVAL DATA PAPER ADVANCE EXTERNAL ENABLE ALL DATA LIMIT DATA INTERVAL DATA
Display Control	Push button switches select one of the following functions for display: ALL CHANNELS MONITOR CHANNEL DATE AND TIME
Time Entry	Push-button switches enable keyboard entry of 3-digit date (DAY) or time-of-day (HR, MIN, SEC) clock operates from 50 or 60 Hz line frequency.
Scan Format	Push-button switches enable keyboard entry of following scan information: FIXED DATA FIRST CHANNEL LAST CHANNEL INTERVAL-HR, MIN, SEC. MONITOR CHANNEL
Program List	Push-button switch enables the printer to record contents of program memory. This includes: channel number, range and function, limits address and limit values, fixed data, monitor channel, time of year, and interval.

Table 1-4. (Cont.)

Programming	Push-button switches enable keyboard entry of unique program data for each of the channels, this includes:
	CHANNEL
	Address 000-999
	Function . . . 40 mV, 400mV, 4V, 40V, T1, T2, T3, T4 and Skip
	Address Limit A . 1 through 15.
	Address Limit B . 16 through 30
	LIMITS
	Address . . . . 1 through 30
	Sense . . . . High or Low
	Polarity . . . . + or –
	Value. . . . . 00000 to 39990
Advance Address	Push-button switch for step advancing channel, limit or monitor channel addresses.
Digital Printer	
Print Speed	2.5 lines/sec.
Print Mechanism	Seiko Model 102
Column Capacity	16
Program Memory	Non-volatile with minimum life of 5 years (program data is retained while power is turned off).

OPTION –05

GENERAL PURPOSE SCANNER

Channel Relay	10 low thermal-emf reed relays
Poles Per Channel	Two (form A)
Shield Switching	One switch for 10 channels
Voltage Offset	$\leqslant 10\,\mu V$
Input Voltage Limit *	170V dc or peak ac max.
Common Mode Voltage Limit (Voltage between chassis and any input)	350V dc or peak ac max provided the Input Voltage Limit is not exceeded.

* Maximum voltage between any two terminals on the scanner. Includes normal mode, as well as, common mode voltages.

OPTION –06

LOW LEVEL SCANNER

Channel Relays	10 low thermal-emf reed relays
Poles per Channel	Three (includes shield switch)
Shield Switching	One switch per channel
Voltage Offset	$\leqslant 1\,\mu V$
Input Voltage Limit *	170V dc or peak ac max.
Common Mode Voltage Limits (Voltage between chassis and any input)	350V dc or peak ac provided the input Voltage Limit is not exceeded.
Over-Current Protection	470Ω resistor in series with each input.

* Maximum voltage between any two terminals on the scanner. Includes normal mode as well as common mode voltages

Table 1-4. (Cont.)

OPTION –07

SOLDER PIN CONNECTOR

Compatibility	Mates with either the –05 or –06 Scanners.
Terminal Style	Solder type.
Number of Terminals	30 (High, Low, Shield per channel)

OPTION –08

ISOTHERMAL BLOCK CONNECTOR

Compatibility	Mates with either the –05 or –06 Scanners.
Terminal Style	Screw type.
Number of terminals	30 (High, Low, shield per channel).
Temperature Gradient between any terminals.	±0.05°C max.
Reference Junction Stability Temperature Range	±.005°C per ° (0°C to 50°C)

OPTION –09

A/D CONVERTER - GENERAL PURPOSE

Measurement Method	Dual slope integration
Full Scale Capability	0 to 39999 counts
Ranges	±400 mV (10 μV resolution) ±4.0V (100 μV resolution)
Accuracy (System *) 90 days +20°C to +30°C	±(0.02% of reading + .005% of range +10 μV)
1 Year +15°C to +35°C	±(0.03% of reading +0.01% of range)
Temperature Coefficient (0° to +20°C, 30°C to 50°C)	±(0.002% of reading +0.001% of range)/°C
Effective Input Impedance	⩾ 200 MΩ See Figure 1. Errors due to source impedance
Zero Stability	Auto zero
Input Overload Voltage	170V dc or peak ac max. (any range)
Common Mode Voltage	350V dc or peak ac max.
Overrange Indication	Front panel display, printer, and output options provide overrange indications
Common Mode Rejection 50 or 60 Hz ±0.1% DC with 1 kΩ Inbalance	140 dB min. 120 dB min.
Normal Mode Rejection	70 dB min. at 50 or 60 Hz ±0.1%
Measurement Speed	3 readings per second, with integration over five line cycles.

* System accuracy ratings apply with a General Purpose Scanner installed. System accuracy includes all instrumentation errors. For example, a/d converter, scanner, power supplies, warm-up time, etc.

Table 1-4. (Cont.)

OPTION –10

A/D CONVERTER – HIGH PERFORMANCE

Measurement Method		Dual slope integration
Full Scale Capability		0 to 39999 counts
Ranges		±40 mV (1 μV resolution) ±400 mV (10 μV resoltuion) ±4V (100 μV resolution) ±40V (1 mV resolution)
Accuracy*		
90 Days		
+20°C to +30°C	(Slow Speed)	±(0.01% of reading + 0.005% of range + 3 μV)
	(Fast Speed)	±(0.01% of reading + 0.008% of range + 5 μV)
1 Year		
15°C to 35°C	(Slow Speed)	±(0.02% of reading +0.01% of range + 5 μV).
	(Fast Speed)	±(0.02% of reading +0.015% of range + 7 μV)
Temperature Coefficient (0°C to 20°C, + 30°C to 50°C)		±(0.001% of reading +0.001% of range)/°C
Effective Input Impedance		
40 mV, 400 mV, 4V Ranges		⩾ 200 MΩ (See Figure 1).
40V Range		10 MΩ (See Figure 1).
Zero Stability		Auto zero
Input Overload Voltage		170V dc or peak ac max., any range
Common Mode Voltage		350V dc or peak ac max
Overrange Indication		Front panel display, printer and output options provide overrange indications.
Measurement Speed		Switch selectable (Fast/slow)
Fast		15 readings per second, with integration over 1 line cycle
Slow		3 readings per second with integration over 5 line cycles.

Common Mode Rejection	Slow Speed	Fast Speed
50 or 60 Hz ±0.1%	140 dB min.	110 dB min.
DC with 1 kΩ Inbalance	120 dB min.	120 dB min.

Normal Mode Rejection (50 or 60 Hz ±0.1%)	
Slow Speed	70 dB min.
Fast Speed	55 dB min.
Reference Voltages	2.0V dc and 0.02V dc.
Reference Accuracy (90 days, +20°C to +30°C)	±0.02%
Reference Stability	
Temperature	±.003%/°C
Time	±.003%/year

*System accuracy ratings apply with a Low Level Scanner installed. System accuracy includes all instrumentation errors. For example, a/d converter, scanner, power supplies, warm-up time, etc.

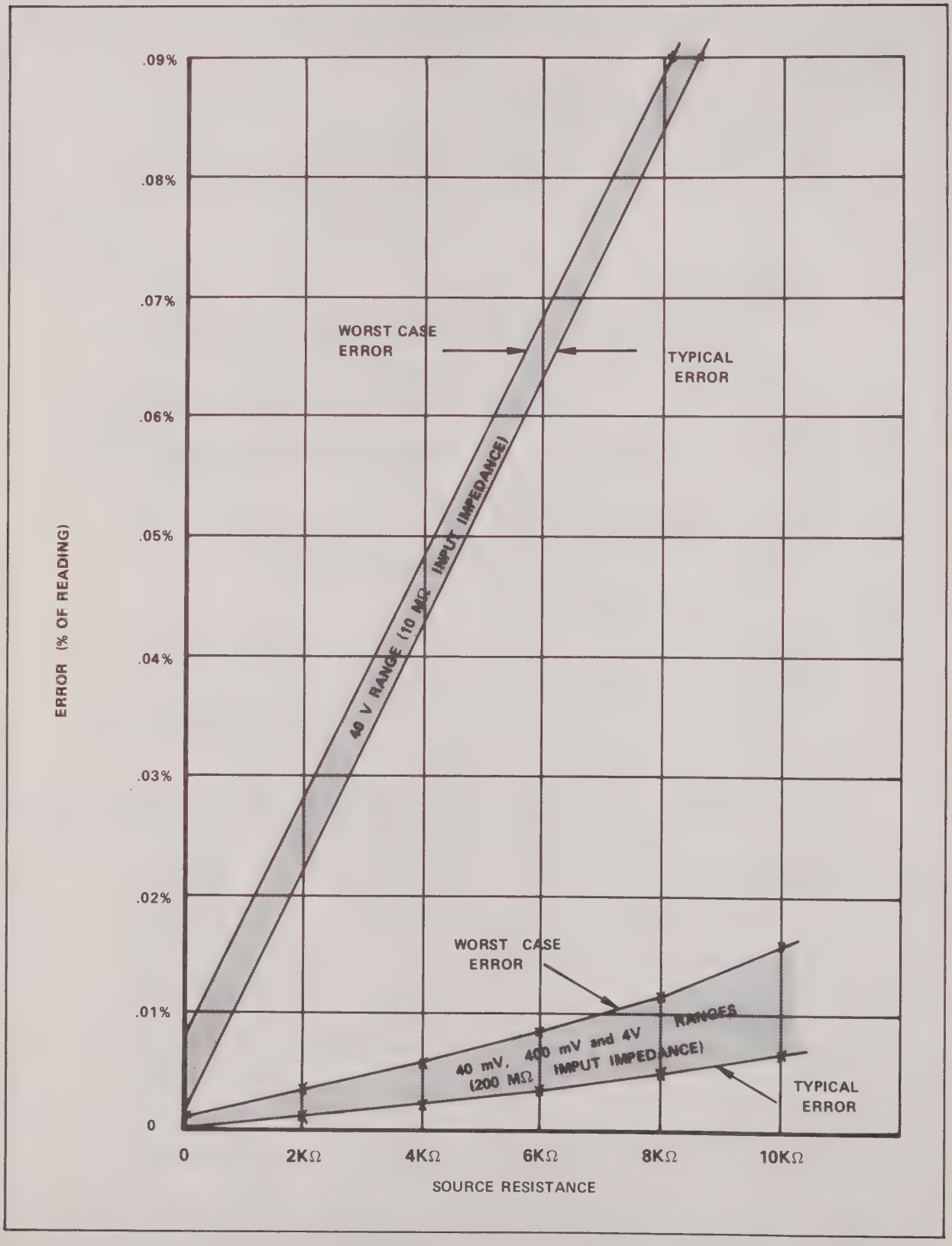


Figure 1. ERROR (% OF READING) VS. SOURCE RESISTANCE.

Table 1-4. (Cont.)

OPTION – 11

TEMPERATURE MEASUREMENT

Compatibility		
A/D CONVERTER	General Purpose (–09) or Low Level (–10)	
SCANNER	General Purpose (–05) or Low Level (–06)	
SCANNER INPUT CONNECTOR	Isothermal (–08)	
THERMOCOUPLES (Choice of four of nine types)	J, K, T, R, S.(Group A) E. B, G, C (Group B)	Select four from Group A or three from group A and one from group B
Recommended Combinations		
0.1° Combination	Options –06, 08 and –10	
1° Combination	Options –05, 08 and –09	
Measurement Resolution (See Tables 1 and 2)		
0.1° Combination		
J, K, & T Thermocouples	0.1° F or 0.1°C	
R, S Thermocouples	0.3° F or 0.2°C	
1° Combination		
All Thermocouple Types	1.0° F or 1.0°C	
Conformity to NBS Tables (See Tables 1 and 2)		
0.1° Combination		
J, K, & T Thermocouples	$\leqslant \pm$ .175° F or $\pm$0.10°C	
R. S. Thermocouples	$\leqslant \pm$ 0.2° F or $\pm$0.1°C	
1° Combination		
J, K, T Thermocouples	$\leqslant \pm$ 0.175°F or $\pm$0.1°C	
R, S Thermocouples	$\leqslant \pm$0.2°F or $\pm$ 0.1°C	
Linearization	Digital with nine thermocouple programs	
Reference Junction Compensation	Automatic from 0°C to +50°C $\leqslant \pm$0.05° error from +15 to +35°C for J, K, E and T thermocouples. $\leqslant \pm$0.2° error from +15 to +35° C for R, S, G and C thermocouples	
Temperature Coefficient, 0 to +20°C and +30 to +50°C		
(0.1° Combination)	$\pm$(0.0015% of reading + 0.01°)/°C	
Open Circuit Detection	Source impedance of $\geqslant$ 7.5k $\pm$2.5kΩ and capacitance less than 0.01 μF is defined as an open circuit.	

Table 1-4. (Cont.)

Table 1. TEMPERATURE SPECIFICATIONS, 0.1° COMBINATION

THERMOCOUPLE TYPE AND TEMPERATURE RANGE	WORST CASE RESOLUTION (Degrees)	NBS CONFORMITY (Degrees)	*SYSTEM ACCURACY (±Degrees)		
			90 Days, +20 to +30°C		1 Year, +15 to +35°C
			SLOW	FAST	SLOW
J Iron-Constantan					
°F −332 to −200	.2	.15	1.0	1.2	1.2
−200 to 32	.1	.15	.8	1.0	1.0
32 to 1400	.1	.1	.6	.7	.7
1400 to 2200	.1	.3	.8	.9	1.0
°C −202 to 0	.1	.083	.6	.7	.7
0 to 760	.1	.055	.4	.5	.5
760 to 1205	.1	.166	.5	.6	.6
K Chromel-Alumel					
°F −332 to −300	.3	.175	1.2	1.5	1.5
−300 to −200	.2	.175	1.0	1.3	1.3
−200 to 32	.2	.175	.8	1.1	1.1
32 to 500	.1	.15	.7	.8	.8
500 to 2500	.1	.15	.8	.9	1.0
°C −202 to −172	.2	.1	.7	.8	.9
−172 to −130	.1	.1	.6	.7	.8
−130 to 0	.1	.1	.5	.6	.6
0 to 260	.1	.083	.4	.5	.5
260 to 1370	.1	.083	.5	.6	.6
T Copper-Constantan					
°F −332 to −300	.2	.1	1.1	1.5	1.5
−300 to −200	.1	.1	1.0	1.3	1.3
−200 to 32	.1	.1	.9	1.1	1.1
32 to 750	.1	.1	.7	.8	.8
°C −202 to −130	.1	.055	.6	.8	.8
−130 to 0	.1	.055	.5	.7	.7
0 to 400	.1	.055	.4	.5	.5
E Chromel-Constantan					
°F −323 to −240	.2	.175	.9	1.1	1.1
−240 to 32	.1	.175	.8	1.0	1.0
32 to 500	.1	.11	.6	.7	.7
500 to 1830	.1	.11	.6	.7	.7
°C −202 to 0	.1	.1	.5	.6	.6
0 to 260	.1	.1	.4	.5	.5
260 to 960	.1	.07	.4	.5	.5
R Pt. 13% Rhodium					
°F 32 to 90	.4	.2	2.8	4.0	4.0
90 to 500	.3	.2	2.6	3.8	3.8
500 to 3200	.2	.2	1.8	2.4	2.5
°C 0 to 260	.2	.1	1.6	2.3	2.3
260 to 350	.2	.1	1.0	1.4	1.4
350 to 1760	.1	.1	1.0	1.4	1.4
S Pt. 10% Rhodium					
°F 32 to 90	.4	.2	2.8	4.0	4.0
90 to 500	.3	.2	2.6	3.8	3.8
500 to 3200	.2	.2	1.8	2.4	2.5
°C 0 to 260	.2	.1	1.6	2.3	2.3
260 to 550	.2	.1	1.0	1.4	1.4
550 to 1760	.1	.1	1.0	1.4	1.4

*FAST = 15 READINGS PER SECOND
SLOW = 3 READINGS PER SECOND

Table 1-4. (Cont.)

Table 2. TEMPERATURE SPECIFICATIONS, 1° COMBINATION

THERMOCOUPLE TYPE AND TEMPERATURE RANGE	WORST CASE RESOLUTION (Degrees)	NBS CONFORMITY (Degrees)	*SYSTEM ACCURACY (± Degrees)	
			90 Days +20 to 30°C SLOW	1 Year +15 to +35°C SLOW
J Iron Constantan				
°F −332 to 32	1	.15	3	4
32 to 1400	1	.1	2	3
1400 to 2200	1	.3	2	3
°C −202 to 0	1	.083	2	3
0 to 760	1	.055	2	2
760 to 1205	1	.166	2	2
K Chromel Alumel				
°F −332 to −200	1	.175	3	4
−200 to 32	1	.175	3	4
32 to 500	1	.15	2	3
500 to 2500	1	.15	2	3
°C −202 to −130	1	.1	2	3
−130 to 0	1	.1	2	3
0 to 260	1	.083	2	2
260 to 1370	1	.083	2	2
T Copper-Constantan				
°F −322 to −200	1	.1	3	4
−200 to 32	1	.1	3	4
32 to 750	1	.1	2	3
°C −202 to −130	1	.055	2	3
−130 to 0	1	.055	2	3
0 to 400	1	.055	2	2
E Chromel-Constantan				
°F −332 to −240	1	.175	3	4
−240 to 32	1	.175	3	4
32 to 500	1	.11	2	3
500 to 1830	1	.11	2	3
°C −202 to 0	1	.1	2	3
0 to 260	1	.1	2	2
260 to 960	1	.07	2	3
R Pt. 13% Rhodium				
°F 32 to 500	4	.2	10	12
500 to 3200	2	.2	7	9
°C 0 to 260	2	.1	6	8
260 to 1760	1	.1	4	6
S Pt. 10% Rhodium				
°F 32 to 500	4	.2	10	12
500 to 3200	2	.2	7	9
°C 0 to 260	2	.1	6	8
260 to 1760	1	.1	4	6

*SLOW = 3 READINGS PER SECOND

Table 1-4. (Cont.)

Open Circuit Indication (Display)	c c c c c (A series of c's.)
Accuracy (system)	See Table 1 and 2. Systems accuracy includes all instrumentation errors, such as, conformity to NBS tables, reference junction compensation, A/D converter, scanners, etc.
Thermocouple Selection	Up to four different types of thermocouples may be specified for use with the –11 option. Each type is identified as T1, T2, T3 and T4 on the front panel and the programming controls.
Temperature Selection (°C or °F)	Switch located inside of the data logger.
–12 SERIES OPTIONS	
TELEPRINTER/CASSETTE INTERFACE OPTIONS	
Compatibility	Specify at time of purchase, using alphabetic suffix as shown in Table 1-2
Output Format	Bit serial
Output Levels	Teletype interface Type 1, 20 mA dc current loop Loop and EIA Standard RS232C.
Output Code	ASCII 8-level
Measurements per Line	1 through 16, switch selectable
Word Format	Unwanted word blocks may be deleted by switches on pcb. Word order cannot be changed
Record Format	CR, LF (Carriage Return, Line Feed) Time-of-Day (days, hrs, min,, s) CR, LF CR, LF, Fixed Data CR, LR Digital Inputs CR, LF (–16 Option) Channels, limit, sign, data, range, function, CR. LF
Baud Rate	110, 300, 1200, 2400, 4800 (Switch selectable)
–13 SERIES OPTIONS	
PAPER TAPE PUNCH INTERFACE	
Compatibility	Designed to interface the data logger output with The Facit Model 4070. Specify requirements at time of purchase using alphabetic suffix as shown in Table 1-2.
Output Format	Character serial
Output Code	ASCII 8-level
Word Format	Unwanted word blocks may be deleted by switches on pcb. Word order cannot be changed.
Record Format	@CR, LF (Carriage Return, Line Feed) Time-of-Day (day, hr., min.) CR, LF CR, LF, Fixed Data CR, LF Digital Inputs, CR, LF (–16 Option) Channels, limit, sign, data, range, function, CR, LF

Table 1-4. (Cont.)

–14 SERIES OPTIONS	
MAGNETIC TAPE INTERFACE	
Compatibility	Specify at time-of-purchase using alphabetic suffix as shown in Table 1-2
Output Format	Character serial
Output Levels	TTL compatible (positive true)
Output Code	BCDIC, EBCDIC or ASCII
Record Format	@CR, LF (Carriage Return, Line Feed) Time-of-Day (day, hr., min.s) CR, LF CR, LF, Fixed Data CR, LF Digital Inputs, CR, LF (–16 Option) Channels, limit, sign, data, range, function, CR, LF
Word Format	Unwanted word blocks may be deleted by switches on pcb. Word order cannot be changed.
Physical Record Length	Fixed. 1 to 4096 characters, switch selectable on pcb.
OPTION –16	
DIGITAL INPUT OPTION	
Number of Digits	Nine
Input Code	BCD, positive-true
Logic Levels	DTL/TTL
Control Inputs	Load Data, Busy, $\overline{\text{Busy}}$
Record Location	Follows Fixed Data
OPTION –20	
PROGRAM MEMORY EXPANSION	
Channel Capacity	Expands basic unit capacity from 128 to 256 channels.
Memory Configurations	256 individual channels or 170 individual channels plus 83 blocks of 10 channels for a total of 1000 channels. Desired configuration is manually selected by internal switch.
OPTION –21	
ALARM SET – 7 SINGLE-LIMITS	
Alarm Limit Values	Memory is provided for assigning 7 single-limit values (polarity, four-digits and HI/LO sense) to ADDRESS LIMIT A (address codes 1 through 7). If two –21 options are installed, memory is provided for seven additional limit values. The second seven limit values are assigned to LIMIT ADDRESS B (address codes 16 through 30).

Table 1-4. (Cont.)

Alarm Limit Addresses	Memory is provided to allow any one-of-seven limit values to be assigned to each of the first 128 channels using ADDRESS LIMIT A (address codes 1 thru 7). If two options are installed, any one-of seven limit values from either or both ADDRESS LIMIT A and B can be assigned to each of the first 128 channels (address 1 thru 7 and 16 thru 22).

OPTION –22

ALARM SET –15 SINGLE-LIMITS

Alarm Limit Values	Memory is provided for assigning 15 single-limit values (polarity, four digits and HI/LO sense) to ADDRESS LIMIT A (address codes 1 thru 15). If two –22 Options are installed, memory is provided for 15 additional limit values. The second 15 limits values are assigned to LIMIT ADDRESS B (address codes 16 thru 30).
Alarm Limit Addresses	Memory is provided to allow any 1-of-15 limit values to be assigned to each of the first 256 channels (or 170 channels and 83 blocks) using ADDRESS LIMIT A (address codes 1 thru 15). If two options are installed, any 1-of-15 limit vlaues from either or both ADDRESS LIMIT A and B (address codes 1 thru 30) can be assigned to each of the first 256 channels (or 170 channels and 83 blocks).

OPTION –23

ALARM SET – POINT OUTPUT

Compatibility	Used in conjunction with Options –21 or –22.
Number of Outputs	30 open-collector outputs (one output for each limit value).
Uncommitted Relays	2 (These relays can be hardwired to any or all of the 30 set point outputs.
Open Collector Output Current	30 mA max.
Relay Contact Rating	50V/1A (15 watts max.)

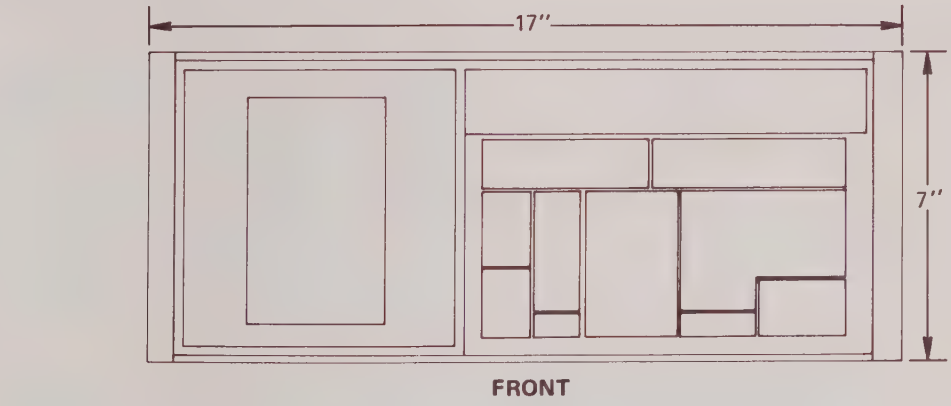
GENERAL

Dimensions	7 in. high x 17 in. wide x 22.47 in. deep (17.78 cm x 43.18 cm x 57 cm) See outline drawing in Figure 1-1.
Weight	Approximately 40 pounds without options (18.144 kg)
Power	Specify one of the following combinations at time of purchase : (50 watts max.) 100V ac ±10%, 50 Hz 100V ac ±10%, 60 Hz 115/230V ac ±10%, 50 Hz 115/230V ac ±10%, 60 Hz
Warm-Up Time	One hour for full accuracy. Accuracy is reduced by 0.02% of range at time of the initial turn-on.

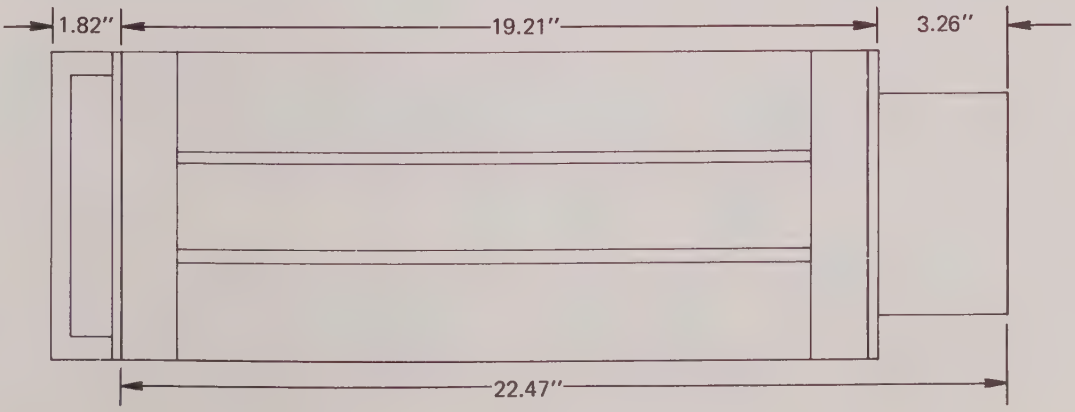
Table 1-4. (Cont.)

ENVIRONMENTAL

Temperature	
Operating	0°C to +50°C
Storage	–40°C to +60°C
Humidity	80% relative humidity, non-condensing, 0 to +35°C 70% relative humidity, non-condensing, +35 to +50°C
Shock and Vibration	Meets MIL-T-28800A, Class 4



FRONT



SIDE

Figure 1-1. OUTLINE DRAWING

Section 2
Operating Instructions

2-1. INTRODUCTION

2-2. This section of the manual contains information concerning the installation and operation of the Model 2240A Data Logger. It is recommended that the contents of this section be read and understood before any attempt is made to operat ethe instrument. Should any difficulties arise during operation, contact your nearest John Fluke Sales Representative, or the John Fluke Mfg. Co., Inc.,P.O. Box 43210, Mountlake Terrace, WA, 98043, Telephone (206) 774-2211. A list of sales representatives is given in Section 7.

2-3. SHIPPING INFORMATION

2-4. The 2240A is packaged and shipped in a foam-packed container. Upon receipt of the instrument, a thorough inspection should be made to reveal any possible shipping damage. Sepcial instructions for inspection and claims are included in the shipping carotn.

2-5. If reshipment of the instrument is necessary, the origitnal container should be used. If the original container is not available, a new container can be obtained from the John Fluke Mfg. Co., Inc. Please reference the instrument's model number when requesting a new shipping container.

2-6. INPUT POWER

2-7. The 2240A can be operated from either 100, 115, or 230V ac, 50 or 60 Hz line power depending upon the combination specified at the time of purchase. Before connecting the unit to line power, check and, if necessary, set the line-voltage and the line-frequency switches.

a. Remove the top dust cover from the instrument.

b. Locate the line-voltage switch shown in figuure 2-1.

c. Refer to the rear panel decal and use a screw driver to set the slide switch so that the specified voltage (100, 115 or 230V ac) appears in the slide aperture.

d. Locate the line frequency switch shown in Figure 2-1.

e. Set the switch to the line frequency (50 or 60 Hz) specified on the rear panel decal

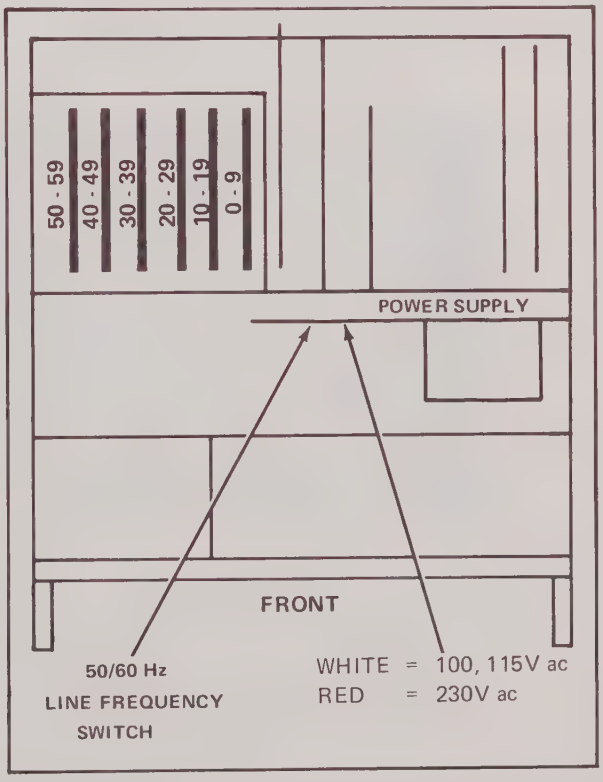


Figure 2-1. POWER SUPPLY VOLTAGE AND FREQUENCY SWITCHES.

NOTE

If it becomes necessary to change the line frequency from that originally specified, a crystal on the guard crossing must be changed. Contact your nearest John Fluke Representative or the John Fluke Mfg. Co., Inc.

f. Install the proper fuse in the rear-panel fuse holder.

100V ac - 1A Slo-Blo
115V ac - ¾A Slo-Blo
230V ac - ⅜ A Slo-Blo

g. Re-install the top dust cover.

2-8. RACK INSTALLATION

2-9. The 2240A is designed for either bench-top use or for installation in a standard 19-inch equipment rack using the accessory Rack Mounting Kit (John Fluke P/N MO7-205-600). Chassis slides (John Fluke P/N MOO-208-610) can also be installed to facilitate access to the instrument when it is installed in an equipment rack. Information regarding the installation of the rack-mounting accessories is included in Section 6.

2-10. OPERATING FEATURES

2-11. The function and location of all 2240A controls and indicators are shown in Figure 2-2 and described in Table 2-1.

2-12. OPERATING NOTES

2-13. The following paragraphs describe various conditions which should be considered before operating the 2240A.

2-14. AC Line Connection

2-15. The rear-panel, three-prong, U-ground connector permits the 2240A to be connected, through a power cord, to either 100, 115 or 230V ac, 50 or 60 Hz line power. The offset prong on this connector is connected to the 2240A chassis and should be connected, via the power cord, to a high quality earth ground.

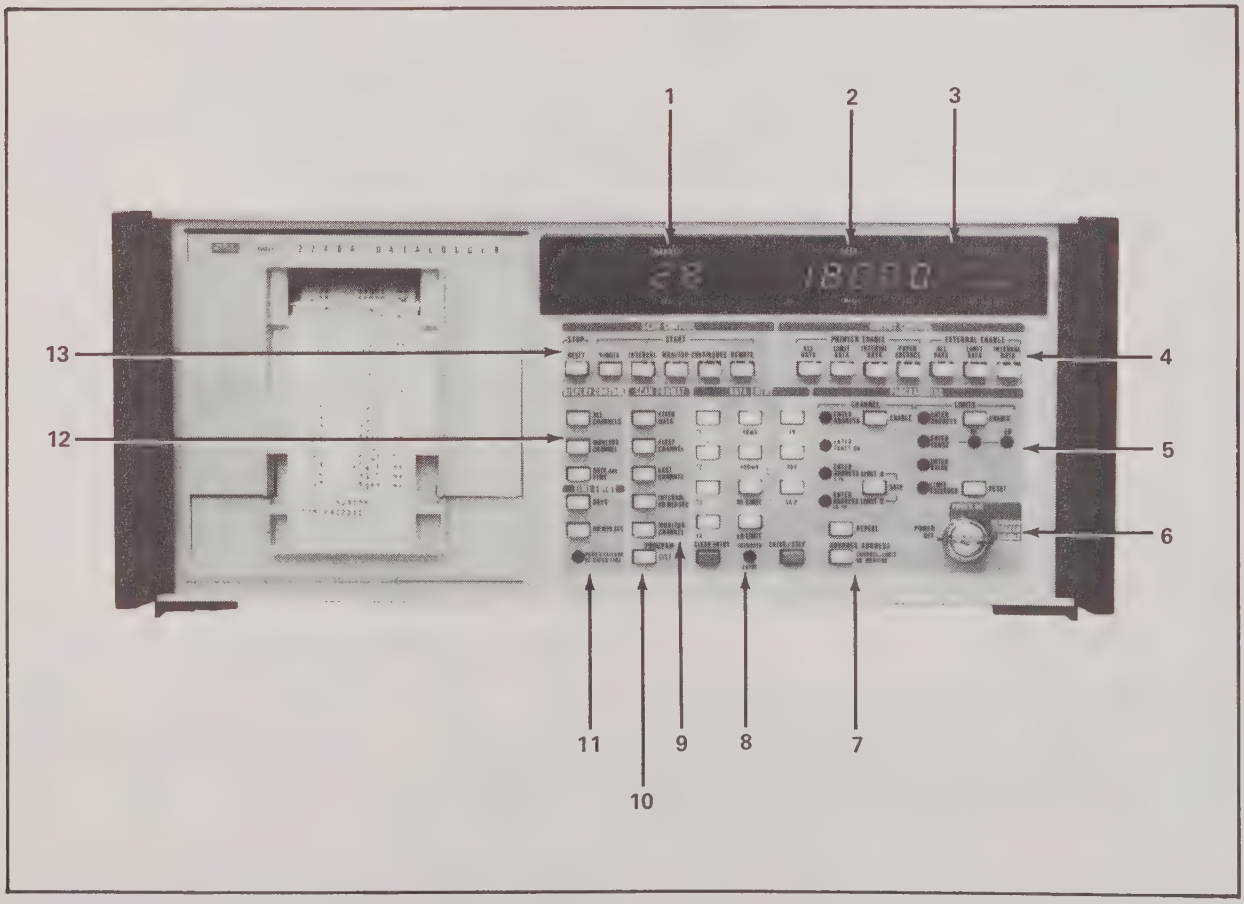


Figure 2-2. 2240A FRONT PANEL CONTROLS AND INDICATORS

Table 2-1. 2240A FRONT PANEL CONTROLS AND INDICATORS

REF. NO.	NAME	FUNCTION
1	CHANNEL/DAY Display	A three digit multi-purpose display which provides a read-out of any one of the following: CHANNEL, DAY or limits address. Channel data is displayed as a three digit number from 000 to 999. Day data is displayed as a three-digit date code from 000 to 999, and can be distinguished from Channel data by a lit DATE AND TIME lamp in the display annunciator group. Limits address data is displayed as a two-digit code from 01 to 30. The left most digit is blanked to distinguish it from both Channel/ Day data.
2	DATA/ HR:MIN:SEC Display	A six digit display which provides a read-out of any one of the following: measurement data (voltage or temperature); time-of-day in hours, minutes and seconds; programmed function; or programmed limit value.
3	Display Annunciator	Four LED's which light on a mutually-exclusive basis to indicate the kind of data currently present at the CHANNEL/DATA display. MILLIVOLTS, VOLTS, and TEMPERATURE indicate the measurement function assigned to the displayed channel. DATE AND TIME indicates that the display is assigned to read the time-of-year (day, hours, minutes, seconds).
4	OUTPUT CONTROL Switches	Seven push-button switches that are divided into two groups (EXTERNAL ENABLE and PRINTER ENABLE) to provide individual control over the type of data to be recorded by the printer and any external recording peripherals. Three switches in each group allow selection of either ALL DATA, LIMIT DATA, or INTERVAL DATA. A fourth switch (PAPER ADVANCE) in the PRINTER ENABLE group allows the printer paper to be manually advanced.
5	PROGRAMMING Switches	Two groups of push-button switches (CHANNEL and LIMITS) that allow function (voltage, temperature or skip) and limit data to be assigned to each channel. Data is assigned via the DATA ENTRY keyboard, and a program sequence for either channel or limits data is initiated by depressing the ENABLE switch in the appropriate group. A lamp is lit to prompt the entry of the necessary data. Each data entry is completed and the sequence is advanced by presssing the ENTER/STEP switch in the DATA ENTRY switch group.

Table 2-1. (Cont.)

REF. NO.	NAME	FUNCTION
6	Power Switch	A three-position key-operated switch used to switch the 2240A on or off. In both the POWER-ON and the KEYBOARD PROGRAM DISABLE position, the data logger is energized and operational. However, program data can only be entered when the switch is in the POWER ON position. Removing the key in the KEYBOARD PROGRAM DISABLE position prevents tampering with or accidental destruction of program data.
7	ADVANCE ADDRESS Switch	A push-button switch which allows the displayed channel or limits address to be sequentially advanced for programming purposes. Also advances the monitor channel address when the monitor channel display is enabled to allow the manual scanning of channels.
8	DATA ENTRY Keyboard	A general purpose push-button keyboard for entering variable magnitude and function program data. The keyboard operates in conjunction with the TIME ENTRY, SCAN FORMAT, and PROGRAMMING switch groups. CLEAR ENTRY and ENTER/STEP switches are also provided. An IMPROPER ENTRY lamp lights to indicate that an attempt to enter illegal data has been made.
9	SCAN FORMAT Switches	A series of push-button switches that allow the format of a scan sequence to be programmed via the DATA ENTRY keyboard. This includes a fixed data heading, first and last channels, and the time interval between the start of scan cycles when operating in the interval scan control mode. When operating the monitor scan control mode, the MONITOR CHANNEL switch allows the monitored channel to be selected via the data entry keyboard.
10	PROGRAM LIST Switch	A push-button switch which enables the operator to solicit a printout of the First-Channel through Last-Channel data in program memory. Prior to pressing the PROGRAM LIST switch, both the RESET switch in the SCAN CONTROL switch group and the ALL DATA switch in the OUTPUT CONTROL group must be depressed. See Figure 2-7 for an example of data listed.
11	TIME ENTRY Switches	Push-button switches that allow the time-of-year clock to be set via the DATA ENTRY keyboard. Separate switches provide for the entry of either the three-digit day-of-year or the six-digit time-of-day. A power failure lamp is also included in this group to indicate the occurrance of a power interruption after the time has been set.

Table 2-1. (Cont.)

REF. NO.	NAME	FUNCTION
12	DISPLAY CONTROL Switches	Three push-button switches that provide for the manual selection of displayed data during a scan sequence. The switches will not interrupt the scan sequence or the recorded data. ALL CHANNELS. . Selects all channels in a scan sequence for display. If the INTERVAL scan control mode is enabled, the time-of-year is displayed between scans. MONITOR CHANNEL . . . . . Selects the programmed monitor channel and its measurement data for display. DATE & TIME. . . . Selects the time-of-year clock for display.
13	SCAN CONTROL Switches	Six mutually-exclusive push-button switches which provide for the selection of a scan control mode. STOP/RESET . . . . Terminates any previously selected scan control sequence. SINGLE. . . . . Initiates the SINGLE scan control mode; i.e., one scan sequence is executed. INTERVAL . . . . . INTERVAL scan control mode. The scan sequence is repeated at a programmed time interval. MONITOR . . . . . Initiates a continuously repeated scan sequence. However, only a single selected channel is monitored during each sequence. CONTINUOUS . . . Initiates a continuously repeated scan sequence. All channels are measured sequentially. REMOTE . . . . . Operates in conjunction with any one of the output options series (−12, −13, or −14) to provide remote start of the scan sequence.

2-16. Printer Paper Installation

2-17. Standard 2¼-inch fan-fold adding machine tape is used as a recording medium for the printer. A package of fan-fold paper is shipped with the 2240A and should be installed before attempting to operate the unit. Use the following procedure for installing the printer paper:

NOTE

The printer is not designed to accommodate rolled paper tape.

a. Fully extend the tape drawer, raise the panel above the drawer to a horizontal position and pull the paper cutter bar away from the printer drum.

b. Pick up the paper pack so that the red marking, (visible on one side of the package is located on the the bottom of the stack (some packs may not have the red markings).

c. Remove the band from the paper and fold-out the top sheet. This provides a leader for loading the tape into the printer mechanism.

d. Hold the pack so that the leader is pointing away from the printer, and slide the pack deep into the tape drawer. When properly positioned, the front of the pack should be just behind the front panel.

e. Turn the printer on using the procedure given in paragraph 2-57.

f. Locate the arrow on the front of the printer mechanism. The arrow points to the paper-feed slot. Hold the paper leader in a horizontal position and insert it as far as possible into the feed slot (≈5/8 of an inch). Depress and hold the PAPER ADVANCE

switch until 8 to 10 inches of leader have been fed through the printer mechanism.

g. Thread the leader through the paper-cutter bar and press the bar back into position.

h. Thread the leader through the front panel opening and close the panel. Check to ensure that the paper is still free to advance.

i. The tape drawer should be left in the extended position, and used to store the printed tape expelled from the printer. Guide the first two or three folds into position in the drawer.

NOTE

Simplified paper loading instructions are given on a decal located in the bottom of the paper drawer.

2-18. Printer Ribbon Installation

2-19. A printer ribbon is supplied with the 2240A and should be installed before attempting to operate the instrument. The ribbon installation location is accessible by raising the printer's front panel to the horizontal position. If the ribbon is already installed, refer to Figure 2-3 and check to ensure that the ribbon is properly positioned on the feed guides and that the ribbon spools are threaded in the proper direction. Use the following procedure for ribbon installation:

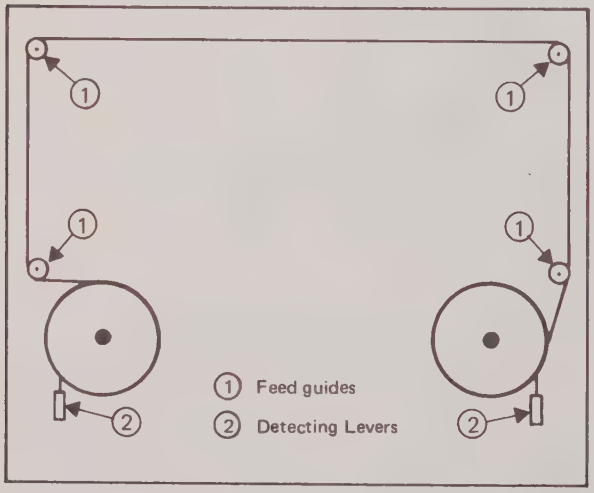


Figure 2-3. PROPERLY INSTALLED RIBBON

a. Separate the ribbon spools and lay them on a flat surface with their finger-side down.

b. Refer to Figure 2-4 and ensure that the ribbon is properly threaded on the spools.

c. On the printer mechanism, locate and push down the detecting lever of either spool shaft (see Figure 2-3) and with the finger side of either spool pointer toward the printer mechanism, slide one of the spools onto the shaft.

Figure 2-4. THREADING DIRECTION FOR RIBBON SPOOLS

d. Unwind 6 or 8 inches of ribbon from the remaining spool, if necessary, and position the ribbon over the feed guides as shown in Figure 2-3.

e. Depress the detecting lever on the empty spool-shaft and slip the second spool onto the shaft. Make sure that there are no twists in the ribbon.

2-20. Option Information

2-21. The front panel operating instructions given in this section of the manual assume that the 2240A contains a full complement of options as shown in Figure 2-5. However, information which is unique to a particular option, such as, description, installation, interface information, maintenance, etc. is contained in the appropriate sub-section of Section 6, Option and Accessory Information.

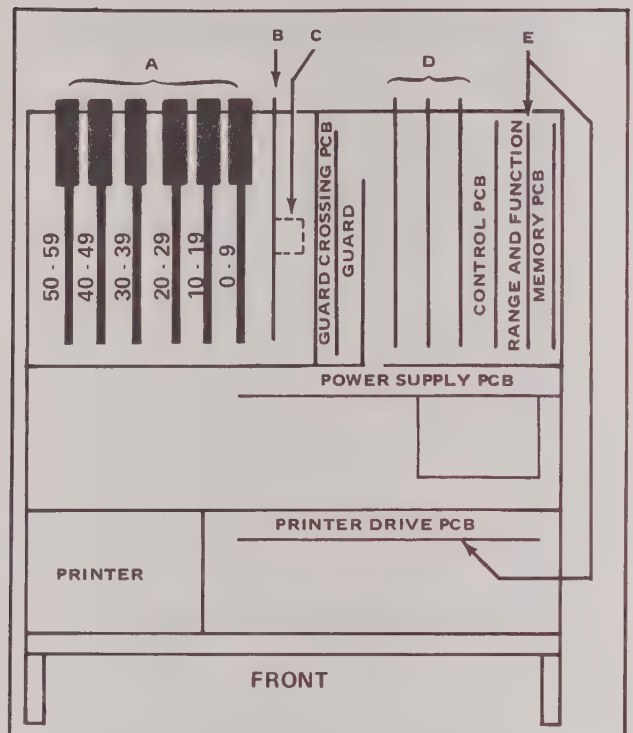
2-22. Scanner Extension

2-23. The channel scanning capacity of the 2240A can be extended from 60 possible channels up to 1000 channels. The extension is accomplished through the use of one or more of the Model 2201A Scanner Extender Chassis which is available as an accessory. The 2201A's interconnect is a daisy-chain fashion, and the first unit in the chain connects to the 2240A rear-panel connector provided by the optional A/D Converter pcb (see location B in Figure 2-5).

2-24. Each 2201A is capable of housing and controlling a maximum of 12 scanner blocks. Since each block contains 10 channels, a total of 120 channels can be added with each 2201A included in the daisy chain. A full complement of 1000 channels would require a series of eight 2201A's. The Model 2201A is described in detail in Section 6, Options and Accessories.

2-25. Program Memory

2-26. The 2240A is equipped with a non-volatile memory which is impervious to power interruptions caused by either power failures or switching the instrument to power off. The memory is maintained under these conditions by a set of lithium batteries which are switched into service when the line operated power supply is shut down. These batter-



A = SCANNER PCB'S (–05, –06) AND THEIR INPUT CONNECTORS (–07, –08).

B = A/D CONVERTER PCB (–09, –10).

C = TEMPERATURE MEASUREMENT SYSTEM (–11). THISS OPTION ALSO REQUIRES THE INSTALLATION OF LINEARIZING IC'S ON THE MEMORY PCB.

D = I/O INTERFACE PCB'S (–16,–23 & –12,–13,–14 SERIES).

E = PROGRAMMABLE LIMITS (–21, –22). IC'S LOCATED ON THE KEYBOARD MEMORY PCB (UNDER PRINTER DRIVE PCB) AND ON THE RANGE AND FUNCTION MEMORY PCB.

Figure 2-5. 2240 OPTION INSTALLATION LOCATIONS

ies will maintain the program memory for a minimum of 5 years.

2-27. Power Failure

2-28. The TIME ENTRY switch group contains a lamp which blinks to indicate the occurrance of a line-power interruption during normal operation of the 2240A. The lamp begins to blink after power is restored and serves as a visual flag to indicate that the displayed time-of-year is in error. The restoration of line power resets the clock to zero, allowing it to operate as an elapsed time counter. Thus, the clock provides a direct read-out of the time elapsed since power was restored. Instructions for resetting the clock are given later in this section under Operation.

2-29. Output Control

2-30. The OUTPUT CONTROL switch group provides the operator with manual control over the operation of the data recording devices associated with the 2240A. The switches are divided into two separate groups: PRINTER ENABLE and EXTERNAL ENABLE. The PRINTER ENABLE switches apply only to the operation of the internal printer. The EXTERNAL ENABLE switches affect all external recording devices which are interfaced with the 2240A.

2-31. The function of the switches in both groups, as they apply to their respective recording devices, are identical with the exception of the printer's PAPER ADVANCE (paper feed) switch which is not featured in the EXTERNAL ENABLE group. Therefore, an explanation of the ALL DATA, LIMIT DATA and INTERVAL DATA switches is sufficient to explain the operation of both switch groups.

2-32. The ALL DATA, LIMIT DATA, and INTERVAL DATA switches are of the push-push type and each is capable of independent operation. When all three switches are in the released or out position, the associated recording devices are inhibited from recording output data from the 2240A. Depressing one or more of the switches allows selected data to be recorded. Table 2-2 lists all of the possible switch combinations, the mode(s) in which data will be recorded, and the kind of data recorded.

Table 2-2. DATA RECORDED FOR VARIOUS OUTPUT CONTROL SWITCH SETTINGS AND SCAN MODES

DATA RECORDED	APPLICABLE MODES				OUTPUT CONTROL SWITCH SETTINGS		
	MONITOR	SINGLE	INTERVAL	CONTINUOUS	ALL DATA	LIMIT DATA	INTERVAL DATA
NONE	X	X	X	X	○	○	○
INTERVAL	X		X	X	○	○	●
LIMIT	X	X	X	X	○	●	○
INTERVAL AND LIMIT	X		X	X	○	●	●
ALL	X	X	X	X	●	○	○
ALL	X	X	X	X	●	○	●
ALL	X	X	X	X	●	●	○
ALL	X	X	X	X	●	●	●

● = DEPRESSED (IN)

○ = RELEASED (OUT)

NOTE

The program list feature requires that both the ALL DATA switch in the PRINTER ENABLE switch group and the RESET switch in the SCAN CONTROL switch group be depressed prior to pressing the PROGRAM LIST switch

2-33. Scan Control

2-34. The scan sequence is both started and stopped by the six switches which comprise the SCAN CONTROL group. Five switches (SINGLE, INTERVAL, MONITOR, CONTINUOUS, REMOTE) are provided to initiate separate variation of the scan sequence, and a single STOP/RESET switch is provided to terminate the selected sequence at any point in time. The basic scan sequence is initiated by the SINGLE switch, and is keyed to manually entered program data. A simplified sequence of events in the single scan mode is as follows:

a. The first channel relay in the program sequence closes and connects an external stimulus to the input of the A/D Converter (Option –09 or –10).

b. The A/D Converter measures the input signal in terms of the programmed function (volts, millivolts or temperature) and provides a digital display of the results.

c. The displayed value is compared against a programmed high and/or low limit value (Option 21 or –22).

d. If a recording device has been enabled, the channel, measurement, and function data are recorded. Also, prior to each scan sequence, the time-of-year and the fixed heading data are recorded.

e. The first channel relay is opened and the second channel relay in the sequence closed to connect its external input to the A/D Converter.

NOTE

Channels between the first and last channels can be skipped under program control. Therefore, the measurement channels may be separated by several skipped channels. For example, the channel sequence might appear as follows: 1, 2, 8, 14, 15, 20. Where, channel 1 is the first channel and 20 is the last channel.

f. Steps b,c and d are repeated.

g. The channel relay is opened and the next programmed channel relay is closed. Its input is measured, compared and recorded.

h. Step g is repeated for each programmed channel until the last channel has been scanned. At that time the single or basic scan sequence has been completed and the display will read the time-of-year clock.

2-35. Variations of the single scan mode include: interval and continuous. The interval scan mode causes the single scan sequence to be repeated at a programmed time interval. The time interval is the time between the start of one sequence and the start of the next sequence. The time can be programmed from a minimum of 1 second to a maximum of 23 hours, 59 minutes and 59 seconds (23:59:59). A 1-second resolution can be achieved for any interval time within the 24-hour limit. The continuous mode causes the scan sequence to be continuously repeated with a minimum time between the end of one sequence and the start of the next sequence (typically $\leqslant$1 second). The monitor scan mode allows the operator to monitor a single selected channel during a scan sequence. The monitored channel is addressed in conjunction with the MONITOR CHANNEL switch in the SCAN FORMAT group and the DATA ENTRY keyboard. Pressing the ADVANCE ADDRESS switch incrementally advances the monitor address and allows the operator to manually scan and measure the input present at each of the accessible channels. The monitor mode is useful for both program verification and troubleshooting.

2-36. The remote mode is operational only when an output option (–12, –13, –14 series) is installed in the 2240A. Depressing the REMOTE switch enables the remote start of a scan sequence. Refer to Section 6, Option and Accessory Information, for details concerning the remote start capabilities of the output options.

2-37. Display Control

2-38. The DISPLAY CONTROL switch group contains three switches which allow the operator to select the data being presented to the display. They are: ALL CHANNELS, MONITOR CHANNEL, DATE and TIME. All channels are displayed when a scan mode is initiated. However, the DISPLAY CONTROL switches allow the display to be changed without interrupting the scan mode.

2-39. Print/Record Format

2-40. Measurement data generated during a scan sequence can be recorded on the printer and/or any enternal recording devices interfaced with the 2240A. Examples of the recording format for any given scan sequence is shown in Figure 2-6. The example assumes the printer as the recording device.

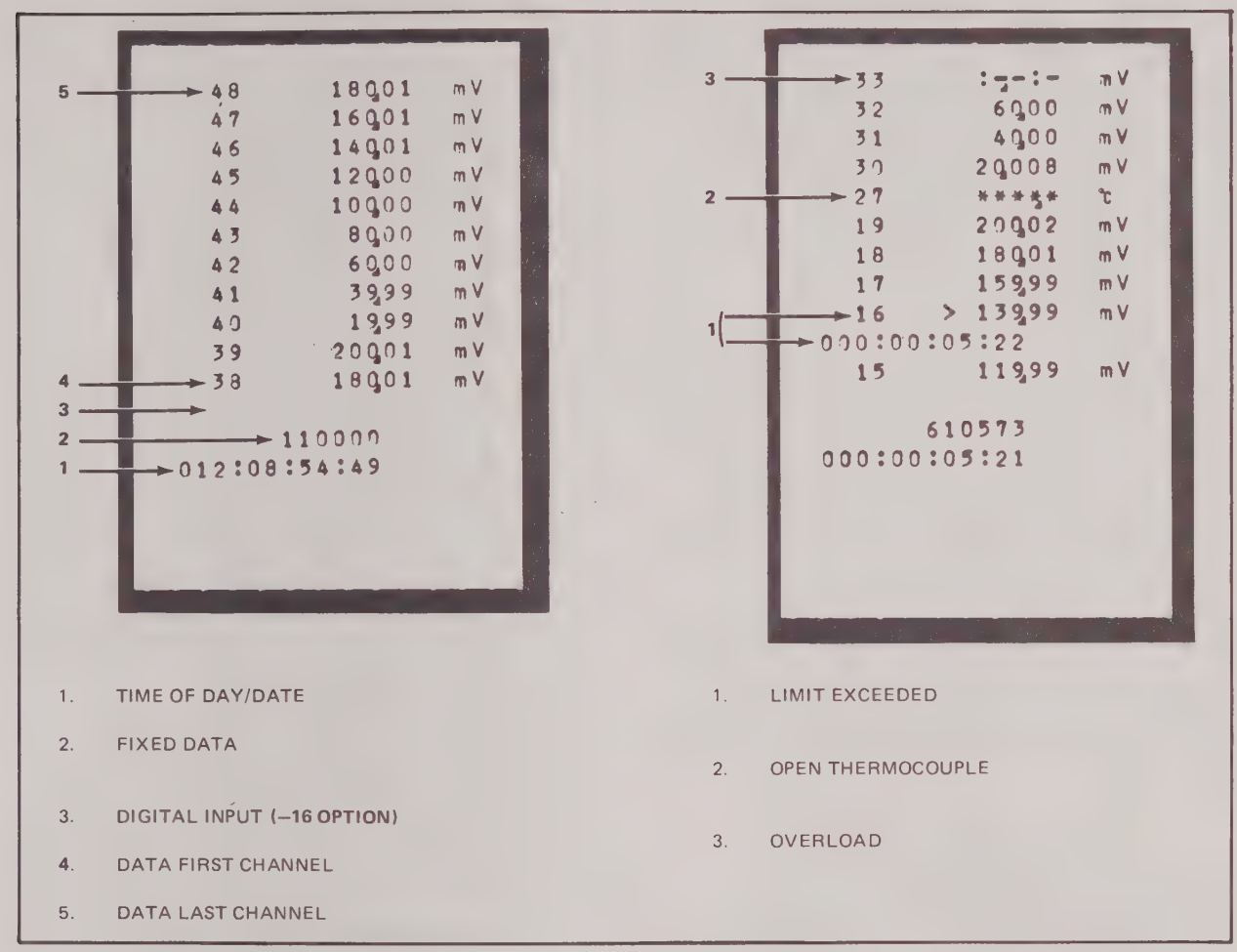


Figure 2-6. TYPICAL FORMAT OF PRINTED DATA

2-41. Fixed Data

2-42. Fixed data is a six-digit number which is recorded after the time-of-year. The six-digit number is manually entered by the operator to identify the program, lot, run, project, etc., associated with the scan sequence and can be any number from 000000 to 999999. Once entered, the number will remain fixed until a new one is entered.

2-43. Improper Program Data

2-44. An IMPROPER ENTRY lamp is provided in the DATA ENTRY switch group to indicate that an attempt to enter illegal program data has been made. An operator error in format or magnitude entry causes the lamp and the displayed data to begin flashing. As long as the lamp is flashing, the STEP/ENTER switch is inhibited to prevent the improper data from being entered into memory. The improper entry condition can be cleared by pressing the CLEAR ENTRY switch.

2-45. Programmable Limits

2-46. The function measurement limits (Option –21) or –22) are available as a block of 30 separate and variable values each of which is addressable for use by all programmable channels. The limits are split into two equal groups (1 to 15 (LIMIT A)) and (16 to 30 (LIMIT B)), and one limit from either or both groups can be assigned to a given channel. However, two limits from the same group cannot be assigned to the same channel. Therefore, when a channel measurement requires two limits, each limit must be taken from a separate limit group.

2-47. The actual value of a limit word can range from a minimum of –39990 to a maximum of 39990. The least-significant digit is not programmable and is always zero. Since the programmed limit value is to be compared directly against the measurement reading, care must be taken to ensure that the limits magnitude is compatible with the selected function and range and visa-versa. For example, a limit value of 10000 can represent a limit of 10.000V, 1.0000V, 100.00mV, 10.000mV, 1000.0°F or 1000.0°C depending upon the selected function.

2-48. When a limit is exceeded during a scan sequence, a LIMIT EXCEEDED lamp in the PROGRAMMING switch group begins to blink, and continues to blink until it is reset. The reset is accomplished by pressing the adjacent RESET switch. Recorded limit data is also identified as greater than (>) or less than (<) the specified limit. In addition, the printer records out-of-limits data in red for easy identification. The time-of-year is also printed prior to each out-of-limits measurement.

2-49. Program List

2-50. The 2240A is equipped with a program-list feature which allows the operator to solicit and record the contents of the program memory. The listed information includes; time-of-day, time interval; fixed data; monitor channel; all available limit addresses (30 maximum) and their respective sense, polarity and value; and channel programming for each channel from first to last. Channel programming includes function and limit data assigned to each channel. A sample of the program list fromat is given in Figure 2-7.

2-51. The program list feature should be employed both before and after entering new program data. By listing the old program, the user will know what must be added to or deleted from memory during the re-programming process. Listing a newly entered program allows the operator to verify its accuracy.

NOTE

The program list feature requires that both the ALL DATA switch in the PRINTER ENABLE group and the RESET switch in the SCAN CONTROL switch group be depressed prior to pressing the PROGRAM LIST switch.

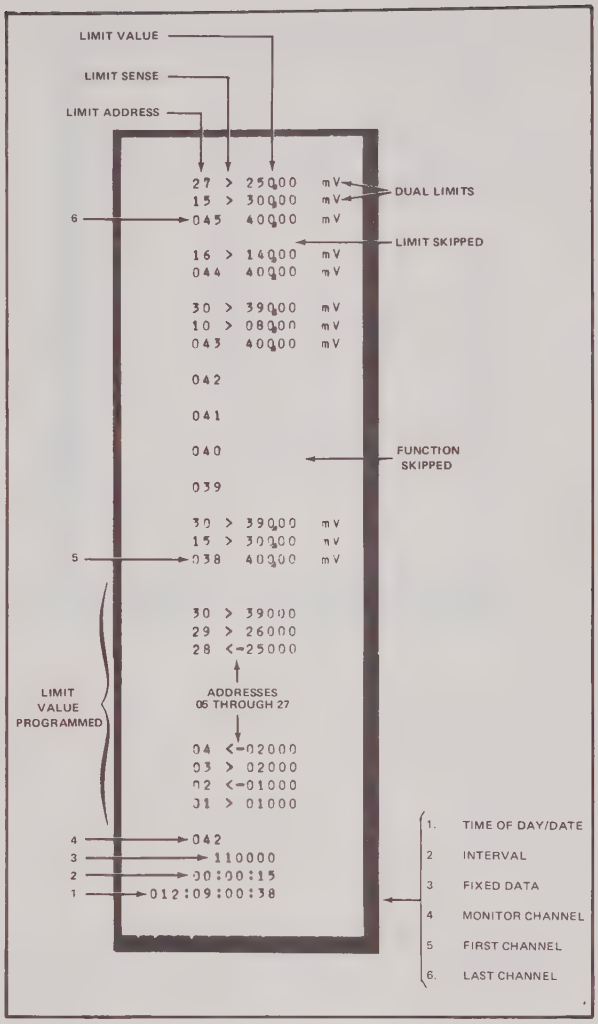


Figure 2-7. TYPICAL FORMAT OF PROGRAM LIST DATA

2-52. Audio-Tone Keyboard

2-53. As a programming aid, the 2240A includes the capability of rejecting the entry of both invalid and improperly formatted program data.The entry of each valid data character is accompanied by an audio tone when one of the keyboard switches is depressed. The tone indicates that the data is valid and has been accepted by the 2240A. The absence of the audio tone indicates that the data is either invalid or improperly formatted and has not been accepted by the 2240A. In this event, press the CLEAR ENTRY switch before attempting to enter the next program character.

2-54. OPERATION

2-55. Turn-On Procedure

2-56. Use of the following procedure is suggested for initial turn-on of the 2240A. With reference to the previous paragraphs turn on the 2240A as follows:

a. Connect the 2240A to line power (See Paragraph 2-6).

b. Install available option, as required.

c. Connect interface cables, as required.

d. Press the STOP/RESET switch in the SCAN CONTROL group.

e. Insert the key in the Power Switch and set it to POWER ON. The display should illuminate and read 2240-1 for approximately 3 seconds. After the 3 seconds, the display will indicate elapsed time starting at zero.

f. Press the ALL DATA switch in the PRINTER ENABLE group.

g. Press the PROGRAM LIST switch. The program currently in memory will be printed.

2-57. Turn-Off Procedure

2-58. The Turn-Off Procedure consists of a single step: Insert the key into the Power Switch and set it to POWER OFF.

NOTE

The turn-off procedure will not clear or alter the program data present in the 2240A.

2-59. Entering Program Data

2-60. Meaningful operation of the 2240A requires the manual entry of a series of program words to define the variables associated with a scan sequence. The procedures required to enter each variable are given in the following paragraphs. Completion of the entire series of procedures, in the order given, is recommended to familiarize the inexperienced operator with the programming requirements of the 2240A. However, it is not necessary for the experienced operator to complete the procedures in the order given. Nor, is it necessary to complete an entire procedure. Thus, variables not affected can be omitted from any of the procedures.

NOTE

Generating a written program prior to entry simplifies the programming process, and ensures duplication of repeat programs. A recommended format for a program form is given at the end of this section in Figure 2-8.

2-61. INITIAL PROCEDURE

2-62. Perform the following procedure prior to attempting to program the 2240A:

a. Complete the Turn-On Procedure given earlier in this section.

b. Set the Power Switch to POWER ON.

c. Release all switches in the EXTERNAL ENABLE section of the OUTPUT CONTROL group.

NOTE

After the 2240A has been programmed, accidental alteration of the program can be avoided by setting the Power Switch to KEYBOARD PROGRAM DISABLE and removing the key from the switch.

2-63. TIME ENTRY

2-64. The time-of-year clock must be updated after the Turn-On Procedure is performed, and after a power interruption has occurred. The POWER FAILURE/RE-ENTER TIME lamp flashes to indicate that the clock is in error. Use the following procedure to update the time-of-year clock.

a. If the DAY display indicates the wrong day, press the DAYS switch in the TIME ENTER group. The HRS: MIN: SEC portion of the display will go blank.

b. On the DATA ENTRY keyboard, serially enter the Julian day-of-year or an equivalent three-digit day code. As each digit is entered, it will be presented on the DAY portion of the display. If the entry was made incorrectly, press the CLEAR ENTRY switch on the DATA ENTRY keyboard and then re-enter the proper day.

NOTE

When using the DATA ENTRY keyboard, it is not necessary to enter leading zeros.

c. After the desired day is displayed, enter it into memory by pressing the ENTER/STEP switch on the DATA ENTRY keyboard. The DATA display should now be illuminated.

d. Press the HR MIN SEC switch in the TIME ENTRY group. The DAY portion of the display should go blank.

e. Serially enter the desired time on the DATA ENTRY keyboard; hours first, seconds last. Remember that the clock is to be restarted at some future time and should be synchronized with the true time-of-day. Therefore, the time entered on the keyboard should agree with the time at which the clock is to be started.

f. Synchronize and start the clock by pressing the ENTER/STEP switch.

2-65. SCAN FORMAT

2-66. The scan format program involves the variables which define the scope of a scan sequence. These include; fixed data, first channel, last channel, time interval, and monitor channel address. Use the following procedure to program the scan format:

a. Press the FIXED DATA switch in the SCAN FORMAT group. The six-digits currently in memory will be presented on the DATA display.

b. If the fixed data is incorrect, serially enter the desired data on the DATA ENTRY keyboard (MSD first) and press the STEP/ENTER switch. If the original data is correct, no action is required.

c. Press the FIRST CHANNEL switch in the SCAN FORMAT group. The first channel address currently in memory will appear on the CHANNEL display.

d. If the channel displayed is incorrect, serially enter the desired first channel on the DATA ENTRY keyboard and press the ENTER/STEP switch. If the original channel is correct, no action is required.

e. Press the LAST CHANNEL switch in the SCAN FORMAT group. The last channel currently in memory will appear on the CHANNEL display.

f. If necessary, enter the correct last channel on the DATA ENTRY keyboard and press the ENTER/STEP switch.

g. Press the INTERVAL HR MIN SEC switch in the SCAN FORMAT group. The time interval currently in memory will be displayed in hours, minutes, and seconds on the DATA display.

h If necessary, enter the desired time interval on the DATA ENTRY keyboard and press the ENTER/STEP switch.

i. Press the MONITOR CHANNEL switch in the SCAN FORMAT group. The current address of the channel to be monitored will appear on the CHANNEL display.

j. If a new monitor channel is desired, enter it on the DATA ENTRY keyboard and press the ENTER/STEP switch.

2-67. LIMITS PROGRAMMING

2-68. The memory required to program measurement limits is available only when the 2240A is equipped with either one or two of the set-point limits options (–21 or –22). The following procedure assumes that two Fifteen Single-Limit Set Point Options (–22) have been installed in the 2240A. Prior to attempting to program the limits, the operator should familiarize himself with the limit capabilities available in his 2240A. A description of each option and its capabilities is given in Section 6. Use the following procedure to assign limit magnitude, polarity, and high or low sense to one or more of the 30 possible limit addresses. To simplify programming, the limits assigned to each address should be determined prior to entering limit address data in the Channel Programming procedure.

NOTE

When two limits are associated with a single measurement, care must be taken to ensure that the limits appear in separate address groups, 1 through 15 for group A, and 16 through 30 for group B. High or low sense can be assigned to any address in either group. However, two limits within one group cannot be utilized simultaneously.

a. Press the LIMITS ENABLE switch in the PROGRAMMING switch group. The ENTER ADDRESS lamp will light.

b. Enter the desired limit address (1 through 30) on the DATA ENTRY keyboard and verify its correctness on the CHANNEL display.

c. Press the ENTER STEP switch on the DATA ENTRY keyboard. The ENTER ADDRESS lamp will go out and the ENTER SENSE lamp will light.

d. Enter HI LIMIT or LO LIMIT as desired on the DATA ENTRY keyboard. The ENTER SENSE HI/LO lamp will indicate the selected sense. Press the ENTER/STEP switch. The ENTER SENSE lamp will go out and the ENTER VALUE lamp will light.

e. Enter the numeric value of the addressed limit on the DATA ENTRY keyboard. If the value is to be negative, press the minus (–) key before, during or after the numeric value is entered. Positive values do not require a polarity entry.

NOTE

The number of digits in a limit value should be compatible with the measurement function it is to be compared with. For example, a limit value of 10000 can represent a limit of 10.000V, 1.0000V, 100.00 mV, 10.000mV, 1000.0°F or 1000.0°C depending upon the selected function.

f. Press the ENTER/STEP switch. The ENTER VALUE lamp will go out and the ENTER ADDRESS lamp will light.

g. Progress to the next applicable limit address by either entering it via the DATA ENTRY keyboard and pressing the ENTER/STEP switch, or pressing the ADVANCE ADDRESS switch. When the correct address is displayed, press the ENTER/STEP switch.

h. Update the limit sense and limit value by repeating steps d, e and f of this procedure.

i. Repeat steps g and h to update any additional limits for use in the scan sequence.

2-69. CHANNEL PROGRAMMING

2-70. Use the following procedure to assign the appropriate measurement function and limits address to each channel included in a scan sequence; i.e., first channel to last channel as defined in the Scan Format program procedure:

a. Press the CHANNEL ENABLE switch in the PROGRAMMING group. The ENTER ADDRESS lamp will light.

b. Using the DATA ENTRY keyboard enter the address of the first channel in the scan sequence and press the ENTER/STEP switch. The selected channel will appear on the CHANNEL display. The ENTER ADDRESS lamp will go out and the ENTER FUNCTION lamp will light.

c. On the DATA ENTRY keyboard, press the appropriate voltage, temperature range or skip for that channel, and then, press the ENTER/STEP switch. The ENTER FUNCTION lamp will go out and the ENTER ADDRESS LIMIT A lamp will light.

NOTE

All measurement functions are available as options. Therefore, prior to attempting to select a function, determine whether or not it is available in your 2240A. The IMPROPER ENTRY lamp will light when an invalid function is selected. The condition is cleared by pressing the CLEAR ENTRY switch or selecting an available function.

NOTE

When the ENTER ADDRESS LIMIT A lamp lights, the address of the limit value assigned to that channel is presented on the DATA display. If a limit is not currently assigned the display will read s s s for skip.

d. If a limit from address group A is required, enter its address on the DATA ENTRY keyboard and press the ENTER/STEP switch. If a limit from address group A is not required, press the SKIP switch adjacent to the ENTER ADDRESS LIMIT A lamp and press the ENTER/STEP switch. In either case the ENTER ADDRESS LIMIT A lamp will go out and the ENTER ADDRESS LIMIT B lamp will light.

e. Either skip or enter a limit address code from address group B and press the ENTER/STEP switch. The ENTER ADDRESS LIMIT B lamp will go out and the ENTER ADDRESS lamp will light.

f. Press the ADVANCE ADDRESS switch. The CHANNEL display will advance to the next channel in the sequence and the ENTER FUNCTION lamp will light.

g. With reference to the following notes, repeat steps c through f of this procedure for each channel in the scan sequence.

1. Any combination of channels between the first and last channels can be skipped by sequentially pressing the SKIP and ENTER/STEP switches when the ENTER FUNCTION lamp is lit. When a channel is skipped, the limit requirements are also skipped.

2. When a series of channels require identical function and limit data, program the first channel in the series using the above procedure. Then alternately press the ADDRESS ADVANCE and the REPEAT switches for each like channel.

FLUKE 2240A PROGRAM FORM

FIRST CHANNEL _____ INTERVAL _____
LAST CHANNEL _____ FIXED DATA _____
MONITOR CHANNEL _____

TEST NO. _____
SH _____ OF _____
DATE _____

CHANNEL PROGRAM

CHANNEL ADDRESS	FUNCTION	ADDRESS LIMIT A (1-15)	ADDRESS LIMIT B (16-30)

LIMIT A PROGRAM

LIMIT ADDRESS	SENSE (HI/LO)	VALUE AND POLARITY
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

LIMIT B PROGRAM

LIMIT ADDRESS	SENSE (HI/LO)	VALUE AND POLARITY
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

Figure 2-8. 2240A PROGRAM FORM, RECOMMENDED FORMAT

Section 3

Theory of Operation

Not available at time of printing

Section 4
Maintenance

4-1. INTRODUCTION

4-2. This section of the manual contains maintenance information for the Model 2240A Data Logger. This includes service information, general maintenance, and a performance test. The performance test is recommended as an acceptance test when the instrument is first received, and later as a preventive maintenance tool to verify proper instrument operation, when necessary. A calibration cycle of 1 year is recommended to maintain the 2240A within the 1-year specifications. If the 90-day specifications are to be maintained, a 90-day calibration cycle is recommended. Table 4-1 lists the recommended test equipment necessary to execute the performance test and calibration procedures. If the specified equipment is not available, alternate equipment having equivalent specifications may be substituted.

Table 4-1. RECOMMENDED TEST EQUIPMENT

INSTRUMENT	RECOMMENDED MODEL
DC Voltage Calibrator	Fluke 343A
DVM	Fluke 8000A
Low Level Scanner	Fluke Option –06
Input Connector	Fluke Option –07 or –08

4-3. SERVICE INFORMATION

4-4. The 2240A is warranted for a period of 1 year upon delivery to the original purchaser. The WARRANTY is given on the back of the title page located in the front of the manual.

4-5. Factory authorized calibration and service for each Fluke product is available at various world-wide locations. A complete list of these service centers is included with the WARRANTY. Shipping information is given in Section 2 of this manual. If requested, an estimate will be provided to the customer before any repair work is begun on instruments that are beyond the warranty period.

4-6. GENERAL MAINTENANCE

4-7. Access Information

4-8. CALIBRATION ADJUSTMENTS

4-9. All calibration adjustments and all plug-in options within the data logger can be accessed for maintenance purposes by removing the top dust cover and the two inner covers located in the top rear of the instrument. Six Phillips head screws hold the top dust cover in place.

4-10. SEIKO MODEL 102 PRINTER HEAD

4-11. Use the following procedure to remove the printer head from the 2240A:

a. Remove the top dust cover from the 2240A.

b. Locate the hinges for the printer's front panel assembly and, with the panel closed, apply pressure, using a thumb or finger, to the rear of one of the hinges. The hinge will snap apart.

c. Using a lateral motion, separate the other hinge and remove the printer's front panel.

d. Disconnect the printer's cable and connector assembly from the Printer Drive PCB. (The cable is located at the bottom of the printer bulkhead).

e. Remove the four large mounting screws at the rear of the printer bulkhead. Support the printer with one hand while removing these screws. (The use of an offset Phillips-head screwdriver is suggested).

f. Fully extend the paper drawer and pull the printer through the front panel opening. Guide the connector sideways between the bulkhead and the rear of the extended paper drawer.

g. Logically reverse this procedure to install the printer head.

4-12. Cleaning

4-13. Clean the Model 2240A periodically to remove dust, grease and other contamination. Separate procedures are given below for cleaning the Seiko Model 102 Printer Head, and the 2240A cables and pcb's.

4-14. SEIKO MODEL 102 PRINTER HEAD

4-15. The printer should be cleaned after using 10 packs of paper or every 90-days. Use the following procedure:

a. Remove the printer head from the chassis using the procedure given in paragraph 4-10.

b. Use a brush or vacuum cleaner to remove dust and other clinging particles.

c. Clean the face of the print drum using a hard bristle brush.

d. Use alcohol or benzine to remove grease and grime from the printer.

CAUTION!

The use of thinner, tri-chloroethelene, ketone, etc, may cause damage to plastic parts on the printer.

4-16. CABLE AND PCB's

4-17. Use the following procedure to clean the interface cables and pcb's used with the data logger.

a. Clean the cables with a soft cloth dampened with a mild solution of detergent and water.

b. Clean the surface of the pcb's using clean dry air at low pressure ($\leq$ 20 psi). If grease is encountered, spray with Freon T.F. Degreaser and remove grime with clean dry air at low pressure.

4-18. Lubrication

4-19. The Seiko Model 102 Printer should be lubricated every 6 months under normal use conditions and, if necessary, after cleaning. Refer to Figure 4-3 and apply the specified lubricant, O2 or G2, to the points indicated. Use a syringe for hard-to-reach lubrication points.

NOTE!

The required lubricants, O2 and G2, can be purchases from: Itronics Lab., 381 Beach Rd. Burlingame, California, 94010. Telephone: 415-342-6712

4-20. Fuse Replacement

4-21. The power fuse is located on the rear panel of the data logger. If replacement is necessary, select the fuse rating according to the local line voltage as listed below:

1. 100V ac – ¾A Slo-Blo
2. 115V ac – ¾A Slo-Blo
3. 230V ac – ⅜A Slo-Blo

NOTE

The fuse holder cap can be replaced with a metric cap (John Fluke pn 424440) which will accept 5 mm x 20 mm fuses.

4-22. Service Tools

4-23. A Special interface cable is required to execute the Performance Test given later in this section. The cable is fabricated using either of the available input connectors, (Option –07 or –08) and a length of 20 gauge insulated wire. The instructions necessary to fabricate the cable are given in Figure 4-1.

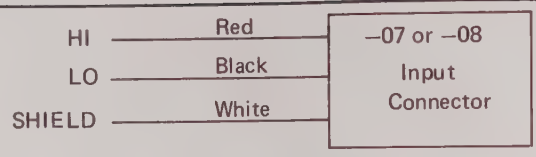
4-24. A set of PCB Extender Cables are available for servicing the plug-in pcb's contained in the data logger. The Extender Cables are available as accessories and are described in Section 6, Option and Accessory Information.

4-25. PERFORMANCE TEST

4-26. The performance test is designed to verify the overall operation of the 2240A, and is intended for use as an acceptance test and/or periodic maintenance check. The equipment used in the test is specified in Table 4-1. The entire test should be executed in the sequence given. If the 2240A fails any part of the performance test, corrective action is indicated.

4-27. Set-Up Procedure

4-28. Prior to executing the performance test complete the following set-up procedure:



Use the following procedure to prepare the above test cable:

1. Cut a 24-inch length of each of the following wires. Use insulated, 20 gauge, stranded wire:
   a. Red
   b. Black
   c. White
2. Refer to the connector decal for pin locations and connect the wires from step 1 to the following connector inputs:
   a. Red wire to HI-0 and HI-5
   b. Black wire to LO-0 and LO-5
   c. White wire to SN-0 and SN-5
3. Strip ½ inch of insulation from the free ends of the red, black and white wires, and tin the exposed wire.
4. Install the following jumpers on the input connector. Use bare copper hook-up wire:

a.	LO-1 to HI-1	e.	LO-6 to HI-6
b.	LO-2 to HI-2	f.	LO-7 to HI-7
c.	LO-3 to HI-3	g.	LO-8 to HI-8
d.	LO-4 to HI-4	h.	LO-9 to HI-9

Figure 4-1. 2200A TEST CABLE

a. Install a Low Level Scanner (Option –06) in slot 0 (Channel 0-9) of the 2240A. The dust cover and the left-rear inner guard should be removed for the duration of the performance test.

b. Attach the test cable described earlier under Service Tools to the scanner in slot 0.

c. Connect the free end of the test cable to the output of the DC Voltage Calibrator.

d. Set the DC Voltage Calibrator for a 0V dc output.

e. Energize the DC Voltage Calibrator.

f. Press the RESET switch in the 2240's SCAN CONTROL group.

g. Press the printer's ALL DATA switch in the 2240A's OUTPUT CONTROL group.

h. Connect the 2240A to line power and set the Power Switch to POWER ON. The DATA display should begin to read elapsed time, and the POWER FAILURE RE ENTER TIME lamp in the TIME ENTRY group should begin to flash.

4-29. Display and Annunciator Test

4-30. Use the following procedure to check the operation of the 2240A front-panel display:

a. Press the FIXED DATA switch in the SCAN FORMAT group. All annunciators and the CHANNEL display should be out. The heading data currently in memory should appear at the DATA display.

b. Using the DATA ENTRY keyboard, enter a series of six 1's. The DATA display should read 111111.

c. Press CLEAR ENTRY switch and enter six 2's on the keyboard. The DATA display should read 222222.

d. Press CLEAR ENTRY switch and repeat the previous step using a series of 3's, 4's, 5's, 6's, 7's, 8's, 9's and 0's. The entered data should appear on the DATA display.

e. Press the MONITOR CHANNEL switch in the SCAN FORMAT group. The monitor channel currently in memory should appear at the CHANNEL display.

f. Using the DATA entry keyboard enter a series of three 1's. The CHANNEL display should read 111.

g. Press CLEAR ENTRY switch and enter three 2's on the keyboard. The CHANNEL display should read 222.

h. Press CLEAR ENTRY switch and repeat the previous step using a series of 3's, 4's, 5's, 6's, 7's, 8's, 9's and 0's. The entered data should appear on the CHANNEL display.

4-31. Time-of-Year Clock Test

4-32. Use the following procedure to check the operation of the time-of-year clock.

a. Press the DAYS switch in the TIME ENTRY group. All annunciators and the DATA display should be out. The day code currently in memory should appear on the DAY (CHANNEL) display.

b. Using the DATA ENTRY keyboard, enter 222 and press the ENTER/STEP switch. The DAY display should read 222.

c. Press the HR:MIN:SEC switch in the TIME ENTRY group. The DAY display should go out and the DATA display should read the time-of-day currently in memory.

d. Using the DATA ENTRY keyboard, enter 235950. The entered data should appear on the DATA display as 23 hours, 59 minutes and 50 seconds.

e. Press the ENTER/STEP switch and observe the display. The clock should start running the instant the ENTER/STEP switch is pressed When the clock makes the transition from 23:59:59 to 00:00:00 ensure that the DAY display changes from 222 to 223.

4-33. Scan Format Test

4-34. Use the following procedure to check the operation of the SCAN FORMAT switches and the associated memory.

a. Press the FIXED DATA switch in the SCAN FORMAT group.

b. Using the DATA ENTRY keyboard, enter 123456 and press the ENTER/STEP switch.

c. Press the FIRST CHANNEL switch in the SCAN FORMAT group. The first channel currently in memory will be displayed.

d. Enter 0 on the DATA ENTRY keyboard and press the ENTER/STEP switch. The CHANNEL DISPLAY should read 000.

e. Press the LAST CHANNEL switch in the SCAN FORMAT Group. The last channel currently in memory will be displayed.

f. Enter 59 on the DATA ENTRY keyboard and press the ENTER/STEP switch. The CHANNEL DISPLAY should read 059.

g. Press the INTERVAL HR:MIN:SEC switch in the SCAN FORMAT group. The time interval currently in memory will be displayed in HR:MIN:SEC on the DATA display.

h. Enter 10 on the DATA ENTRY keyboard and press the ENTER/STEP switch. The DATA DISPLAY should read 00.00.10 (sec).

i. Press the MONITOR CHANNEL switch in the SCAN FORMAT group. The CHANNEL display should read the monitor channel currently in memory.

j. Enter 5 on the DATA ENTRY keyboard and press the ENTER/STEP switch. The CHANNEL display should read 005.

k. Starting with FIXED DATA sequentially press each switch in the SCAN FORMAT group and ensure that the previously entered data is displayed.

l. Set the Power Switch to POWER OFF for at least 1 second and then set it to POWER ON. The POWER FAILURE RE ENTER TIME lamp should begin to flash.

m. Repeat step k.

n. Reset the POWER FAILURE RE ENTER TIME lamp by pressing the DAY or HR:MIN:SEC switch in the TIME ENTRY group and the ENTER/STEP switch on the DATA ENTRY keyboard.

4-35. Channel Programming Test

4-36. Use the following procedure to check the operation of the Channel Programming circuits:

a. Press the PROGRAM LIST switch. The printer should print the time-of-year; interval in hours, minutes, and seconds, fixed data; the monitor channel; and all available limit addresses (30 max.) and their assigned values. This data is then followed by a list of all channels within the first and last channel limits. The assigned measurement function and range is printed on the channel line. If limits data has been assigned to the channel, the limit address, high (>) or low (<) sense, and the limit value is printed on the line following the channel data.

b. Press the ENABLE switch in the CHANNEL PROGRAMMING group and enter the number of the first channel listed by the printer. Press the ENTER/STEP switch. The ENTER FUNCTION lamp should light.

c. Press the SKIP switch on the DATA ENTRY keyboard and then press the ENTER/STEP switch.

d. Identify the next channel printed on the program list and enter it on the DATA ENTRY keyboard.

NOTE

When practical, use the ADVANCE ADDRESS switch to call up the next applicable channel.

e. Press the REPEAT switch in the CHANNEL PROGRAMMING switch group.

f. Repeat steps e and f of this procedure for all remaining channels listed by the printer.

g. Press the PROGRAM LIST switch. Fixed data, limits data and channel numbers should be printed. However, channel data should not be printed.

h. Press the ENABLE switch in the CHANNEL PROGRAMMING group and enter an address of 0.

i. Press the ENTER/STEP switch. The ENTER FUNCTION lamp should light.

j. Select the 4V function on the DATA ENTRY keyboard and press the ENTER/STEP switch.

k. Press the SKIP and ENTER/STEP switches for both LIMIT A and LIMIT B. The CHANNEL ENTER ADDRESS lamp should light.

l. Enter an address of 005 using eh DATA ENTRY keyboard and press the ENTER/STEP switch.

m. Press the REPEAT switch.

n. Call the following channel addresses using the DATA ENTRY keyboard, and press the REPEAT switch after each is entered: 10, 15, 20, 25, 30,35, 40, 45, 50, 55.

o. Press the PROGRAM LIST switch. The standard heading and each of the programmed channels and their function should be printed.

p. Set the Power Switch to POWER OFF for 1 second and then set it to POWER ON.

q. Repeat step o.

4-37. Scan Control Test

4-38. The following procedure checks the operation of the 2240A scan control logic and measurement circuitry:

NOTE

This procedure assumes that the data entered during the Scan Format and Channel Programming checks is still in memory.

a. Adjust the calibrator for an output of 1.0000V dc.

b. Press the SINGLE switch in the SCAN CONTROL group. The printer should record inputs of 1.0000 V dc at channels 0 and 5, and ≈0V dc at all other channels.

c. Press the STOP/RESET switch in the SCAN CONTROL group.

d. Set the DC Voltage Claibrator for an output of 2.0000V dc.

e. Press the INTERVAL switch in the SCAN CONTROL group. The printer should record a 2.0000V dc reading for channels 0 and 5. The scan cycle should repeat itself at the programmed interval (10 sec).

f. Press the MONITOR switch in the SCAN CONTROL group. The display should indicate a 2.0000V dc input to channel 5.

g. Increase the calibrator output to 5.0V dc. The DATA display should read uuuuu to indicate the presence of an overrange voltage.

h. Press the CONTINUOUS switch in the SCAN CONTROL group. The printer should print :, – – : – V for both channels 0 and 5 to indicate the presence of an overrange voltage. The scan cycle should continue to repeat with a minimum time between the end of one cycle and the start of the next.

i. Press the STOP/RESET switch in the SCAN CONTROL group.

4-39. Output Control Test

4-40. Use the following procedure to check the operation of the OUTPUT CONTROL logic:

NOTE

This procedure assumes that the Scan Control Test has been completed and that the conditions existing at the end of that check are still present.

a. Press the LIMIT DATA switch in the PRINTER ENABLE group.

b. Press the INTERVAL switch in the SCAN CONTROL group. The display should indicate an overrange for both channels 0 and 5, but the printer should not record data.

c. Reduce the output of the voltage calibrator to

3.9000V dc. The display should indicate 3.9000 for both channels 0 and 5, and the printer should not record data for either channel.

d. Press the INTERVAL DATA switch in the PRINTER ENABLE section of the OUTPUT CONTROL group. The printer should record the displayed data for channels 0 and 5 each time a scan sequence occurs.

e. Press the CONTINUOUS switch in the SCAN CONTROL group. The scansequence should be continuously repeated, and data should be printed on the initial scan and every 10 seconds thereafter.

f. Press the RESET switch in the SCAN CONTROL group.

4-41. Display Control Test

4-42. Use the following procedure to check the operation of the DISPLAY CONTROL group.

a. Release all switches in the PRINTER ENABLE section of the OUTPUT CONTROL group.

b. Press the CONTINUOUS switch in the SCAN CONTROL group. The data logger should alternately display channels 0 and 5 and their associated voltage readings.

c. Press the DATE AND TIME switch in the DISPLAY CONTROL logic. The display should read the current output of the time-of-year clock. The clock should be running.

d. Press the MONITOR CHANNEL switch in the DISPLAY CONTROL group. The display should read channel 005 and its associated input voltage, (3.9000V).

e. Press the ALL CHANNELS switch in the DISPLAY CONTROL group. The display should alternately display channels 0 and 5 and their associated voltage readings.

f. Press the RESET switch in the SCAN CONTROL group.

g. Disconnect the calibrator, and remove the test cable and the scanner from the 2240A

h. Install the inner guard cover and the top dust cover.

i. Set 2240A POWER switch to OFF and disconnect line power.

4-43. CALIBRATION

4-44. The 2240A should be calibrated every 1 year/90 days (as required to maintain desired accuracy) or whenever repairs have been made in the Power Supply or the A/D Converter (Option −09 or −10). Calibration should be accomplished at an ambient room temperature of +22 to +25°C and a relative humidity of less than 70%. Table 4-1 lists the required equipment.

4-45. Initial Procedure

a. Remove the top dust cover from the 2240A.

b. Press the RESET switch in the SCAN CONTROL group.

c. Connect the 2240A to line power and set the Power Switch to ON.

d. Allow the 2240A to stabilize for a period of not less than 1 hour.

4-46. Power Supply

4-47. Use the following procedure to calibrate the Power Supply PCB:

a. Connect the DVM to tp1 (common) and tp2 (−10.2 Vdc) on the Power Supply PCB. See Figure 4-2.

b. Adjust pot R17 to obtain a reading of −10.20 ±.05V dc.

c. Move the DVM input from tp 2 to tp 3. The DVM should read +5.1 ±.2V dc.

d. Move the DVM input from tp 3 to tp 4. The DVM should read +16 ±1.0V dc.

4-48. AD/Converter (Option −09 or −10)

4-49. The 2240A may contain either-of-two A/D converters; a 10 μV version (Option −09) or a 1 μV version (Option −10), Refer to the appropriate subsection of Section 6 for calibration instructions.

4-50. Temperature Measurement System (Option −11)

4-51. The Temperature Measurement System does not require calibration. However, the accuracy is dependent upon the calibration of the A/D Converter and the Isothermal Block Connectors.

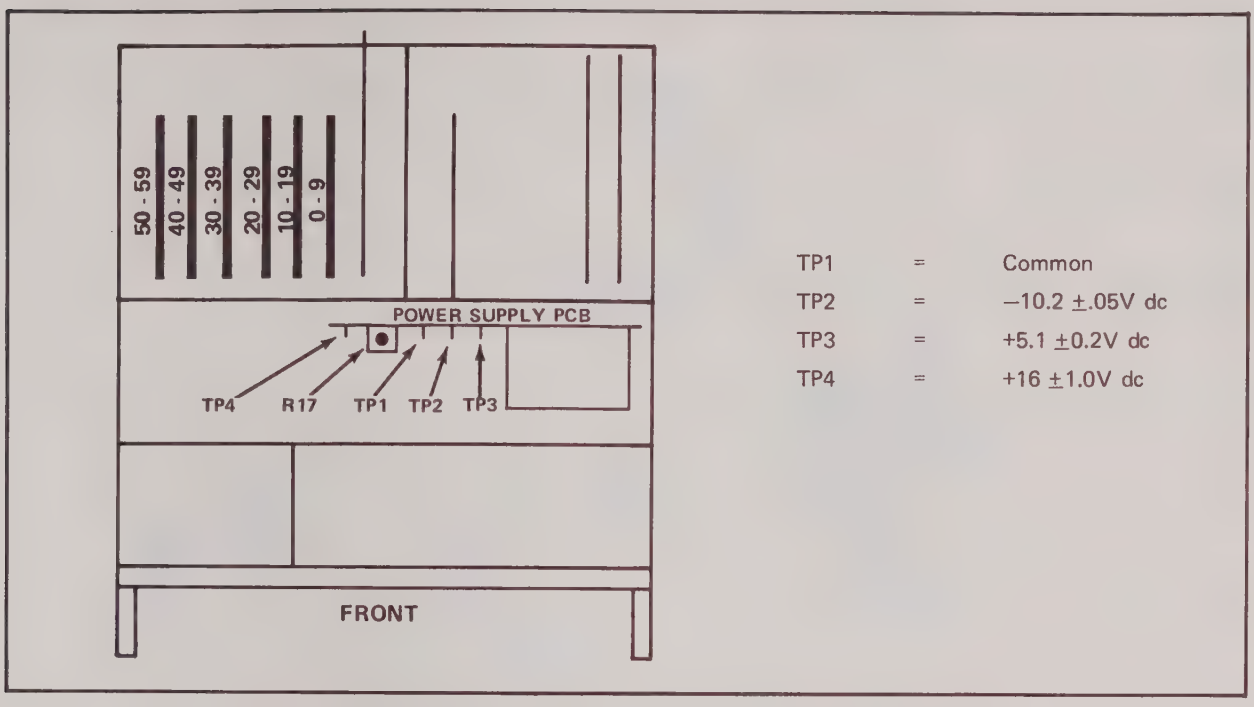


Figure 4-2. POWER SUPPLY TEST POINT AND ADJUSTMENT LOCATIONS.

4-52. Isothermal Block Connectors

4-53. The basic 2240A is capable of housing up to six Isothermal Block Connectors (Option −08) for use in conjunction with the Temperature Measurement System (Option −11). Each Isothermal Block Connector has been calibrated at the factory and does not require periodic calibraton. However, if a connector has been repaired or if the seal on the factory adjustment has been broken, calibration is required. Refer to subsecton −08 in Section 6, Option and Accessory Information, for the calibration procedure.

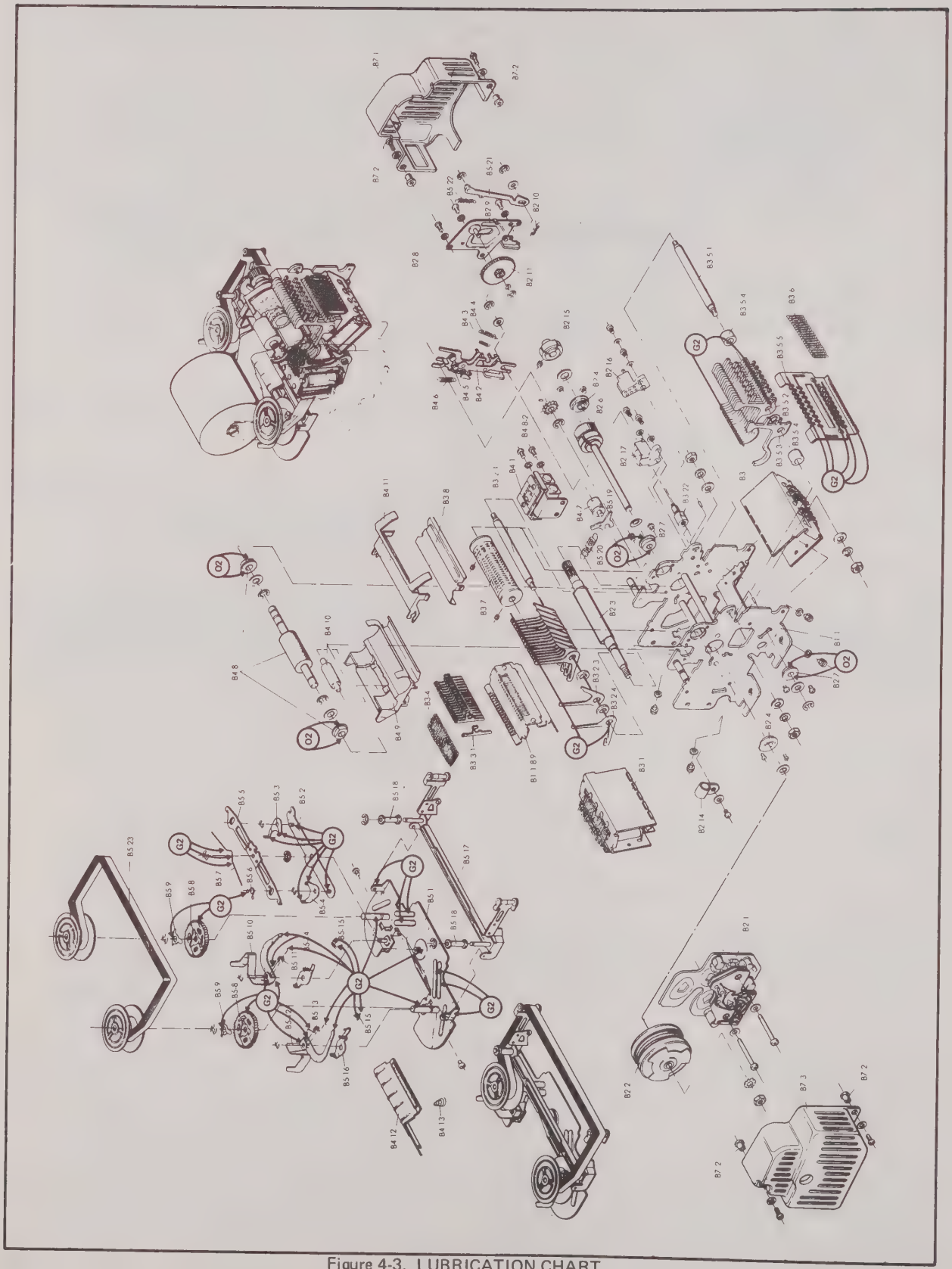


Figure 4-3. LUBRICATION CHART

Section 5
Lists of Replaceable Parts

OPTION	NAME	DWG. NO.	PAGE
	Mother Board PCB Assembly		
	Reference Designations	2200A-1601	5-3
	Parts List	2200A-4001	5-4
	Power Supply PCB Assembly		
	Reference Designations	2200A-1602	5-5
	Parts List (2 sheets)	2200A-4002	5-6
	Controller PCB Assembly		
	Reference Designations	2200A-1603	5-8
	Parts List	2200A-4003	5-9
	Guard Crossing PCB Assembly		
	Reference Designations	2200A-1604	5-10
	Parts List (2 sheets)	2200A-4004	5-11
–09	General Purpose A/D Converter PCB Assembly		
	Reference Designations	2200A-1605	5-13
	Parts List (2 sheets)	2200A-4005	5-14
–05	General Purpose Scanner PCB Assemlby		
	Reference Designations	2200A-1606	5-16
	Parts List	2200A-4006	5-17
	Printer Drive PCB Assembly		
	Reference Designations	2200A-1607	5-18
	Parts List	2200A-4007	5-19
	Display PCB Assembly		
	Reference Designations	2240A-1608	5-20
	Parts List	2240A-4008	5-21
	Mode Switch PCB Assembly		
	Reference Designations	2240A-1609	5-22
	Parts List	2240A-4009	5-23
	Keyboard Switch PCB Assembly		
	Reference Designations	2240A-1611	5-24
	Parts List	2240A-4011	5-25
	Keyboard Logic PCB Assembly		
	Reference Designations	2240A-1612	5-26
	Parts List (2 sheets)	2240A-4012	5-27
	Keyboard Memory PCB Assembly		
	Reference Designations	2240A-1613	5-29
	Parts List	2240A-4013	5-30

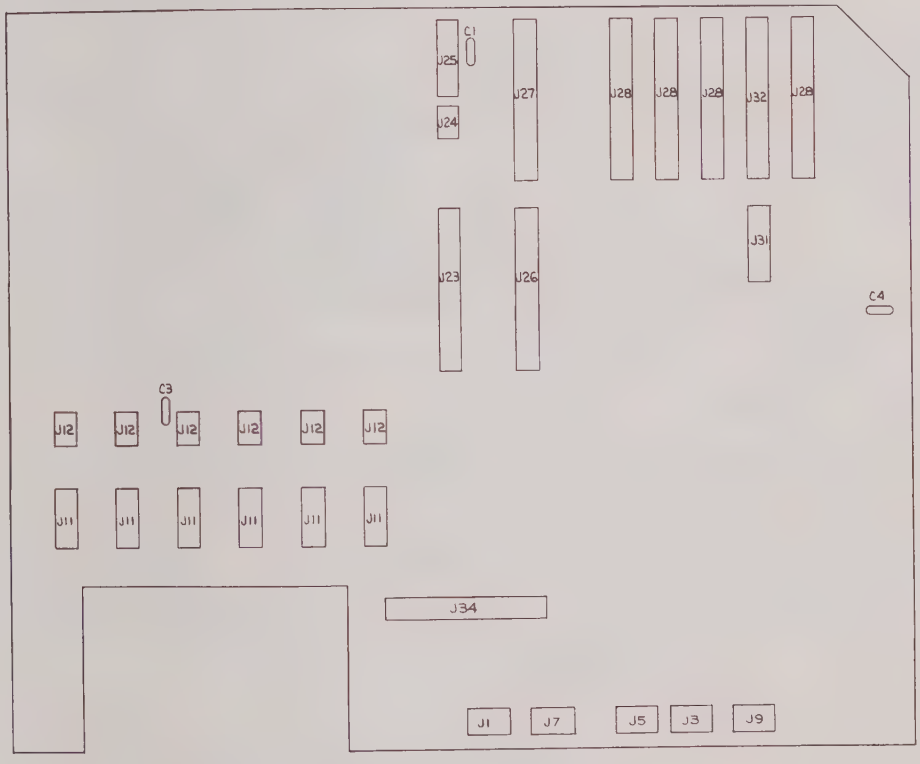
(continued on page 5-2)

LIST OF REPLACEABLE PARTS, *continued*

OPTION	NAME	DWG. NO.	PAGE
–12, –13, & –14 Series	Digital Output Interface PCB Assembly		
	Reference Designations	2200A-1614	5-31
	Parts List	2200A-4014	5-32
–16	Digital Input PCB Assembly		
	Reference Designations	2200A-1617	5-34
	Parts List	2200A-4017	5-35
–11	Temperature Measurement System PCB Assembly		
	Reference Designations	2200A-1621	5-36
	Parts List	2200A-4021	5-37
–08	Isothermal Block Connector		
	Reference Designations	2200A-1623	5-38
	Parts List	2200A-4023	5-39
–10	High Performance A/D Converter PCB Assembly		
	Reference Designations	2200A-1628	5-40
	Parts List (2 sheets)	2200A-4028	5-41
–06	Low Level Scanner PCB Assembly		
	Reference Designations	2200A-1629	5-43
	Parts List (2 sheets)	2200A-4029	5-44
–23	Alarm Output PCB Assembly		
	Reference Designations	2240A-1631	5-46
	Parts List	2240A-4031	5-47
	Range and Function Memory PCB Assembly		
	Reference Designations	2240A-1632	5-48
	Parts List	2240A-4032	5-49

NOTES
UNLESS OTHERWISE SPECIFIED:

1. FOR ASSEMBLY SEE 2200A-4001
2. FOR SCHEMATIC DIAGRAM SEE 2200A-1001



	RELEASED TO PRE PROD		
A	DEL C2		
	RELEASED TO PILOT		
REV	CHANGE DESCRIPTION	DR	CHK

PROPRIETARY NOTICE

FLUKE | JOHN FLUKE MFG CO., INC. P O BOX 7428 SEATTLE WA | 89536 | DO NOT SCALE DRAWING DIMENSIONS IN INCHES

DR M. BROWN 6-24-78
CHK T. HICKEY 6-26-78
ENG [illegible] 6-26-78

TOLERANCES
XX ± .020
XXX ± .010
ANGLES ± 1°
.000 - .100 DIA +.003 -.002
.101 - .200 DIA +.004 -.002
.201 - .500 DIA +.005 -.003
.501 - 1.00 DIA +.010 -.005

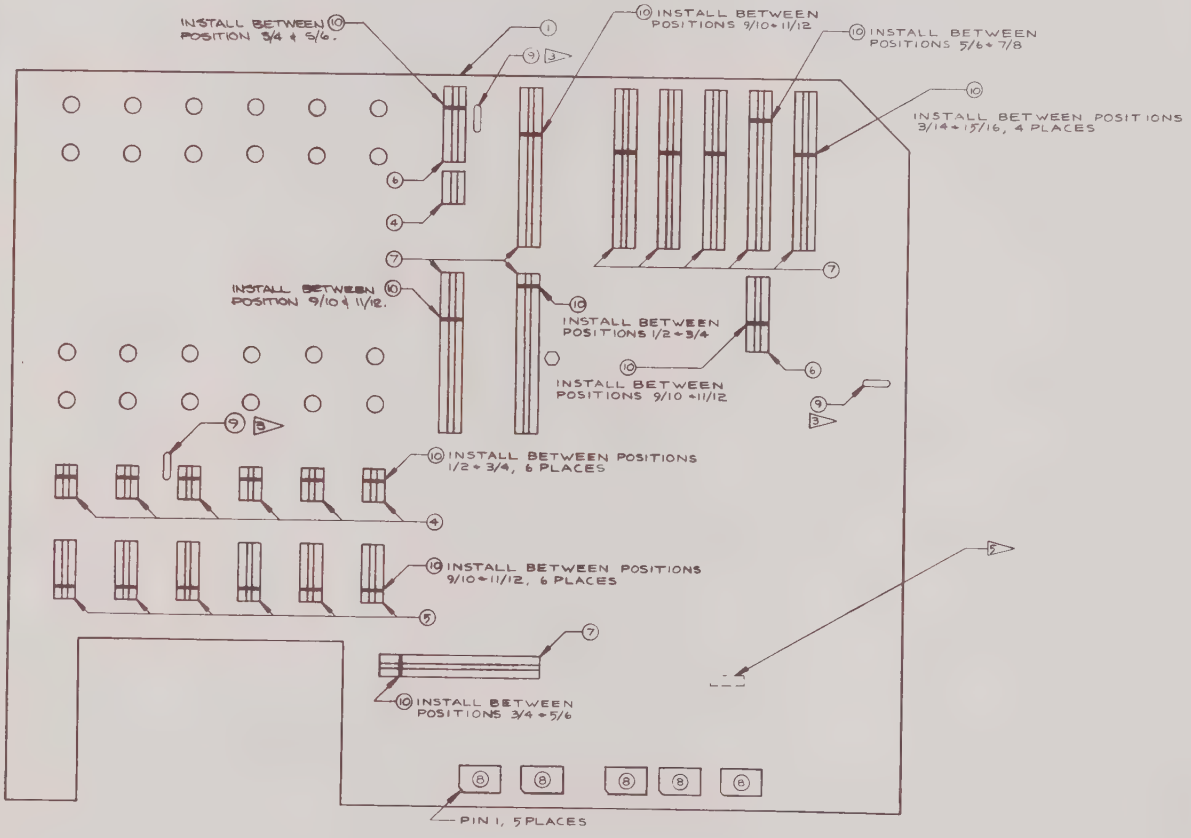
MATERIAL
FINISH

MOTHER BOARD REFERENCE DESIGNATION DRAWING

PART NO.	SIZE	DRAWING NO.
	D	2200A-1601

SCALE 1/1 SHT 1 OF 1 REV A

ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409136	PCB, 2200A-3001	1
2				
3				
4	J12, J24	291625	CONN., 3 POSN.	7
5	J11	291898	CONN., 6 POSN.	6
6	J25, 31	408484	CONN., 8 POSN.	2
7	8	404947	CONN., 18 POSN.	9
8	2	276527	SOCKET, 14 PIN D.I.P.	5
9	C1 C3,04	407403	CAP., 20,000 PF	8
10		424572	INSERT, POL. KEY	23


INSTALL BETWEEN (10) POSITION 3/4 & 5/6.
(10) INSTALL BETWEEN POSITIONS 9/10 & 11/12
(10) INSTALL BETWEEN POSITIONS 5/6 & 7/8
(10) INSTALL BETWEEN POSITIONS 3/14 & 15/16, 4 PLACES
INSTALL BETWEEN (10) POSITION 9/10 & 11/12.
(10) INSTALL BETWEEN POSITIONS 1/2 & 3/4
(10) INSTALL BETWEEN POSITIONS 9/10 & 11/12
(10) INSTALL BETWEEN POSITIONS 1/2 & 3/4, 6 PLACES
(10) INSTALL BETWEEN POSITIONS 9/10 & 11/12, 6 PLACES
(10) INSTALL BETWEEN POSITIONS 3/4 & 5/6
PIN 1, 5 PLACES

NOTES:

1. REFERENCE SCHEMATIC 2200A-1001.
2. ASSEMBLY PER S.O.P. 111.8.
3. TRIM LEADS .100 LONG, MAX.
4. CLEAN ASSY. PER S.O.P. 89.4.
5. MARK ASSY REV. LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177, OR EQUIVALENT).
6. FOR REFERANCE DESIGNATION DRAWING SEE 2200A-1601.

8 J23, 26, 27, 28, 32, & 34

9 J1, 3, 5, 7, 9.

REV	CHANGE DESCRIPTION	DR	CHK	APPR
	RELEASED TO PRE-PROD			
C	ITEM 8 WAS: 387916 DELETED C2, QTY OF ITEM 9 WAS 4			
	RELEASED TO PILOT			
B	ADDED NOTE 6. REV 5 ADDED REV J SCREEN			
A	REV SCREEN "J" NO'S			

PROPRIETARY NOTICE

FLUKE — JOHN FLUKE MFG CO INC, P.O. BOX 7428 SEATTLE WA

89536 — DO NOT SCALE DRAWING, DIMENSIONS IN INCHES

TOLERANCES

DR G. SCHILLING 6/6/75
CHK Mark Smith 6/6/75
ENG [illegible] 6-12-75
ENG [illegible] 7-11-75

MATERIAL SEE BOM

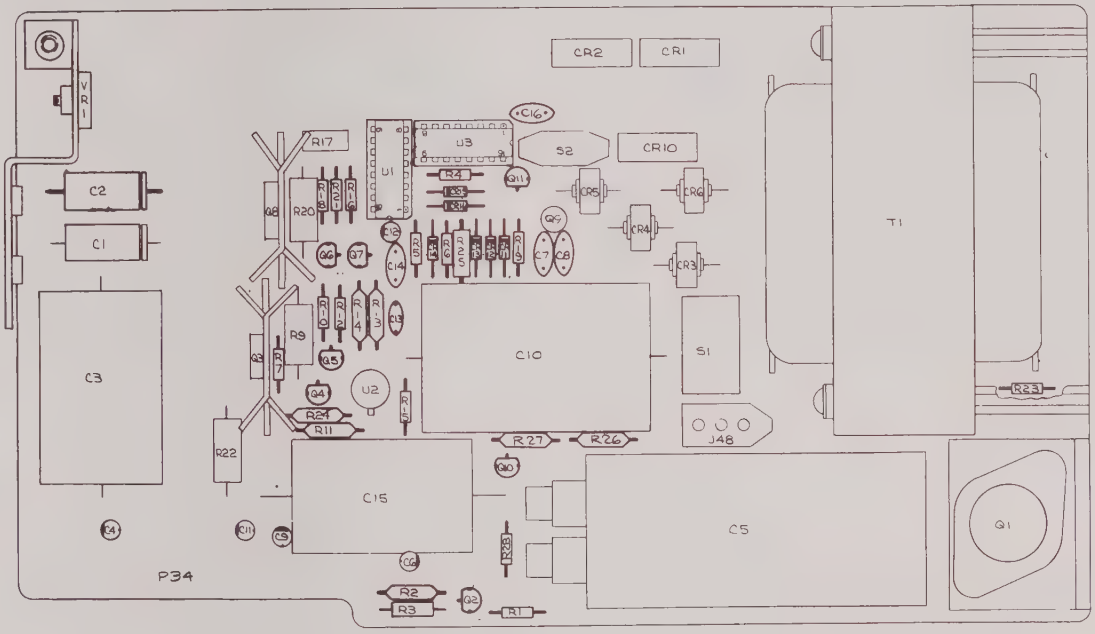
FINISH SEE NOTES

MOTHER BOARD ASSY.

PART NO	SIZE	DRAWING NO
406306	D	2200A-4001

SCALE 1/1 SHT OF REV C

NOTES:
UNLESS OTHERWISE SPECIFIED
1. FOR ASSEMBLY SEE 2200A-4002.
2. FOR SCHEMATIC DIAGRAM SEE 2200A-1002.



REV	CHANGE DESCRIPTION	DR	CHK	APPR
	RELEASED TO PRE-PROD	BEM 7/15/76		
A	ADDED Q10,11,R26,27,28	BEM 7/15/76	DAS 7/15/76	
—	RELEASED TO PILOT	DR 7/15/76	CHK 7/15/76	APPR 7/15/76

PROPRIETARY NOTICE

JOHN FLUKE MFG CO INC
P O BOX 7428 SEATTLE WA
89536
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES
TOLERANCES

DR M. BROWN 6-25-76
CHK T. MOREY 7/15/76
ENG M. SCHROEDER 7-15-76
ENG ROBERT BROOKS 7-15-76
MATERIAL
FINISH

PWR SUPPLY, REFERENCE DESIGNATION DRAWING

PART NO —
SIZE D
DRAWING NO 2200A-1602
SCALE 2/1
SHT 1 OF 1
REV A

ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409144	POWER SUPPLY PCB	1
2				
3				
4				
5	T1	409979	TRANSFORMER 2200A-6510	1
6				
7				
8				
9				
10	R1	202879	RESISTOR 1/4W, 5%, 2K OHM	1
11	R2	288555	RESISTOR 1/8W, 1%, 953Ω	1
12	R3	293720	RESISTOR 1/8W, 1%, 2.37K	1
13	R4,6	148163	RESISTOR 1/4W, 5%, 47K	2
14	R5,23	148023	RESISTOR 1/4W, 5%, 1K	2
15				
16	R7	218032	RESISTOR 1/4W, 5%, 510	1
17				
18	R9	219352	RESISTOR 2W, 5%, 0.62 OHM	1
19	R12	148114	RESISTOR 1/4W, 5%, 15K	1
20	R11	223529	RESISTOR 1/8W, 1%, 7.50K	1
21	R10	170720	RESISTOR 1/4W, 5%, 2.7K	1
22	R13,26,27	168260	RESISTOR 1/8W, 1%, 10K	3
23	R14	293597	RESISTOR 1/8W, 1%, 1.15KΩ	1
24	R15	193433	RESISTOR 1/4W, 5%, 2.4K	1
25	R16	193185	RESISTOR 1/4W, 10%, 100Ω	1
26	R17	291120	RESISTOR, VAR., 1/2W, 10%, 500Ω	1
27	R18	193342	RESISTOR 1/4W, 5%, 5.1KΩ	1
28	R28, 19	148189	RESISTOR 1/4W, 5%, 100K	2
29	R20, 22	248658	RESISTOR 2W, 5%, 1.20 OHM	2
30	R21	147967	RESISTOR 1/4W, 5%, 330Ω	1
31				
32				
33	R24	294868	RESISTOR 1/8W, 1%, 5.11KΩ	1
34	R25	208733	RESISTOR 1/2W, 10%, 22M	1
35				
36				
37				
38				

ITEM	REF DES	P/N	NOMENCLATURE	QTY
39				
40	C1, C2	238919	CAPACITOR 100uF	2
41	C3	309245	CAPACITOR 8000uF	1
42	C4,11,15,16	330662	CAPACITOR 10uF	4
43	C5	310367	CAPACITOR 15,000uF	1
44	[13] C6,9,14	149161	CAPACITOR .05uF	3
45	C10	309927	CAPACITOR 8,000uF	1
46	C12	161343	CAPACITOR 4.7uF	1
47	C13	105565	CAPACITOR .002uF	1
48	C15	370742	CAPACITOR 2100uF	1
49	C7	161919	CAPACITOR 1uF	1
50				
51				
52				
53				
54				
55	CR1,2,10	246509	BRIDGE	3
56	[12] CR3,4,5,6	325746	RECTIFIER MR751	4
57	[11] CR7,8,9,11,12	203323	DIODE 1N4148	5
58	VR2	277236	DIODE ZENER 5.6	1
59				
60	Q1	418095	TRANSISTOR 2N6383	1
61	Q405,2,10	218396	TRANSISTOR 2N3904	3
62	Q3	386128	TRANSISTOR TIP120	1
63	Q6,7,11	195974	TRANSISTOR 2N3906	4
64	Q8	325720	TRANSISTOR MJE3055	1
65	Q9	261578	TRANSISTOR U1897E	1
66				
67				
68				
69				
70	VR1	355107	I.C. 7805	1
71	U1	381830	I.C. 4050AE	1
72	U2	310219	I.C. LM304H	1
73	U3	404251	I.C. MC14566CP	1
74				
75				
76				

ITEM	REF DES	P/N	NOMENCLATURE	QTY
77				
78				
79		265[illegible]	SOCKET 16 PIN 133-51-02-006	2
80	S1	234224	SWITCH .1A .437	1
81	S2	280[illegible]3	SWITCH .1.1 SPDT	1
82				
83				
84				
85	J48	342998	PIN, TERMINAL 02-09-2133	3
86		417154	CONNECTOR 03-09-2032	1
87				
88				
89				
90		411710	HEATSINK 2200A-2032	1
91		386235	HEATSINK	2
92		374934	HEAT SINK BKT 2200A-2031	1
93		101493	INSULATOR, MICA	1
94		195354	BUSHING, TEFLON	2
95		104794	STRAP, RUBBER .075 DIA 3L	3
96				
97				
98				
99				
100				
101				
102		110775	WASHER, FLAT, #4	1
103				
104				
105		152124	SCREW 4-40 X 3/8	4
106		110395	WASHER, LOCK #4	1
107		110635	NUT 4-40 HEX, STL	2
108		218941	SCREW 10 32 X 1/4	2
109		101030	LUG 1 1/4L #174	2
110		152173	SCREW 6-32 X 1/2	2
111		110692	WASHER, LOCK #6	2
112		110551	NUT 6-32 HEX, STL	2
113		110312	WASHER LOCK #10	2

[1] SHOULDER WASHER AND MICA INSULATOR SUPPLIED WITH ITEM 70.

[2] ASSURE PROPER SPACING BETWEEN ITEM 5 AND ITEM 90.

[3] USE 3 P-NUTS MOUNTED TO PCB AS SPACERS TO ACHIEVE PROPER SPACING FROM P.C.B. (.10")

[4] CR11, 12, 14, 15, 16

[5] CR3, 4, 5, 6

[6] C8, 14, 16

[7] CONED-DISK SPRING AND MICA INSULATOR SUPPLIED WITH ITEM 64

[8] SHOULDER WASHER AND MICA INSULATOR SUPPLIED WITH ITEM 62

[9] INSERT ITEM 94 IN HEATSINK HOLES, 2 PLACES, BEFORE MOUNTING TRANSISTOR.

[10] OBSERVE POLARITY AS MARKED WHEN MOUNTING CAPACITOR.

[11] MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177 OR EQUIVALENT).

5 CLEAN ASSEMBLY PER S.O.P. 89.4.

4. TRIM LEADS TO .100 MAX LONG

3 ASSEMBLE PER S.O.P. 111.8.

2 FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1602.

1. FOR SCHEMATIC DIAGRAM SEE 2200A-1002.

NOTES:

SEE SHEET 2 FOR ASSY. DWG.

REV	MAN-DESCRIPTION	DR	CHK	APPR
B	ITEM 21 REF DES WAS R24 ITEM 9 REF DES WAS R9	FAB		
	RELEASED TO PRE PROD			
A	ITEM 92 WAS: 414128 DELETED ITEM 587-05104 ITEM 22, 14 & 13 QTY WAS: 1 ITEM 34 WAS: 149415 ITEM 44 QTY WAS: 9 ADDED ITEMS 49 & 58 ITEM 60 QTY WAS: 2 ITEM 63 QTY WAS 3 CHANGED 79 WAS: 367324 CHANGED 80 WAS: 376758			
	RELEASED TO PILOT RUN			

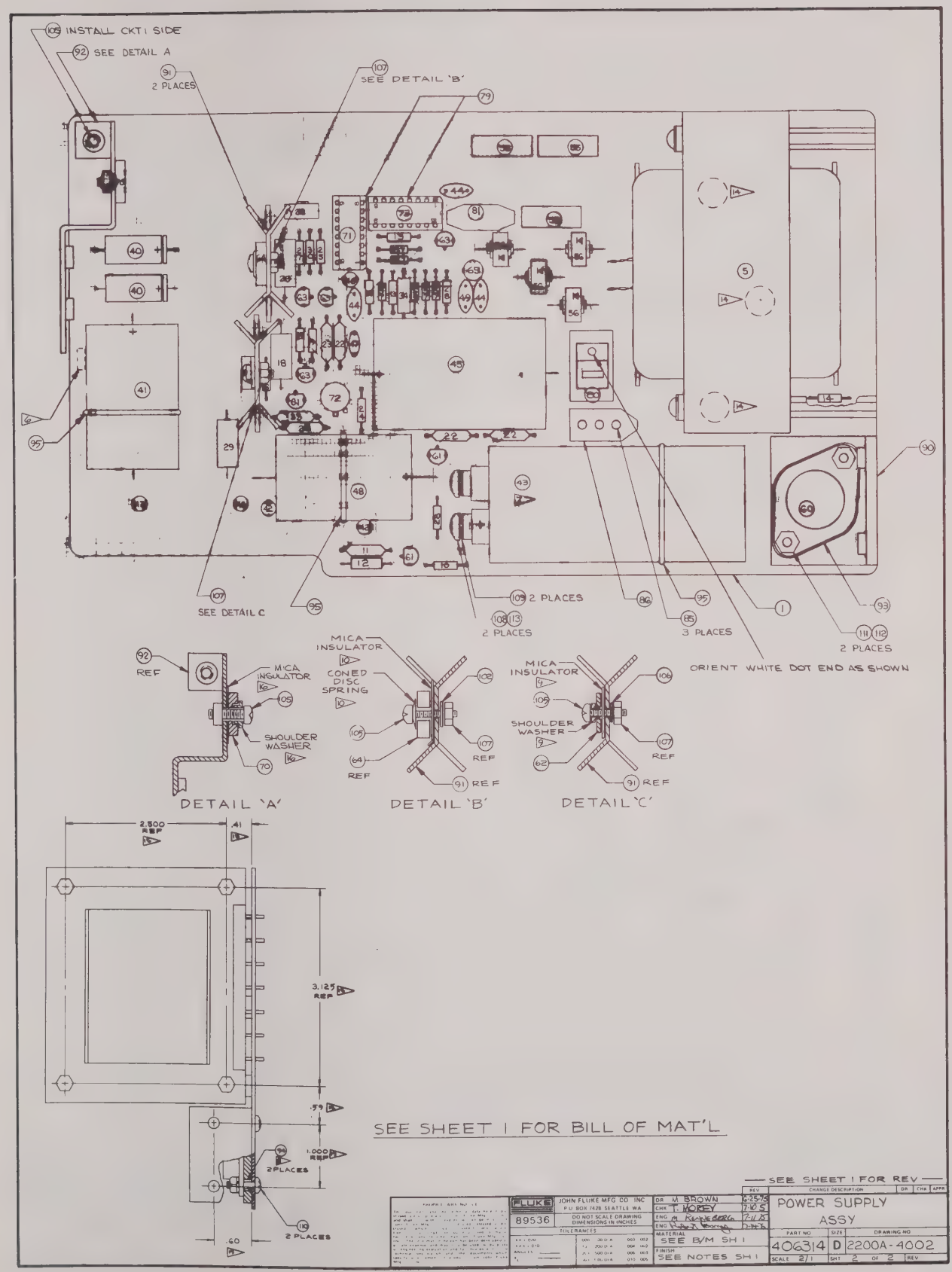
PROPRIETARY NOTICE

FLUKE 89536	JOHN FLUKE MFG CO. INC P.O. BOX 7428 SEATTLE WA	DR M. BROWN	6-25-8
	DO NOT SCALE DRAWING DIMENSIONS IN INCHES	CHK T. MOREY	7-05
	TOLERANCES	ENG M. REAMSNYDER	7-11-5
		ENG R. BEACH	7-19-5
		MATERIAL SEE B/M ABOVE	
		FINISH SEE NOTES	

POWER SUPPLY ASSY

PART NO	SIZE	DRAWING NO
406314	D	2200A-4002

SCALE 2/1 SHT 1 OF 2 REV B



SEE SHEET 1 FOR BILL OF MAT'L

SEE SHEET 1 FOR REV

REV	CHANGE DESCRIPTION	DR	CHK	APPR

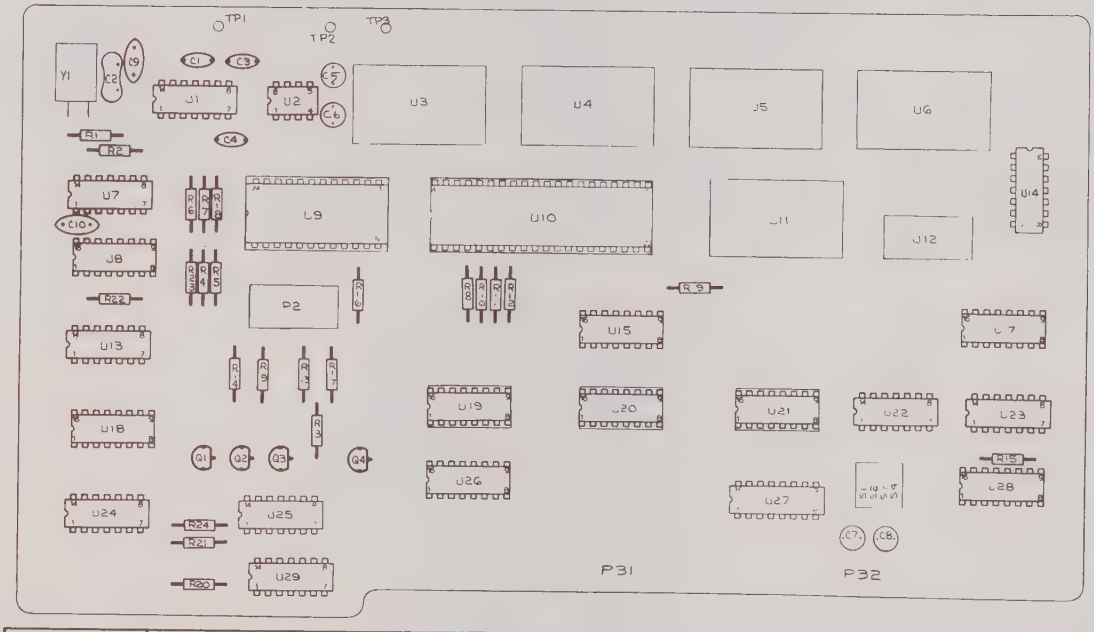
FLUKE	JOHN FLUKE MFG CO INC P U BOX 7428 SEATTLE WA	DR M. BROWN	6-25-75
89536	DO NOT SCALE DRAWING DIMENSIONS IN INCHES	CHK T. MOREY	7-10-75
		ENG M. Rutherford	7-11-75
	TOLERANCES	ENG [illegible]	[illegible]
		MATERIAL SEE B/M SH 1	
		FINISH SEE NOTES SH 1	

POWER SUPPLY ASSY

PART NO	SIZE	DRAWING NO
406314	D	2200A-4002

SCALE 2/1 SHT 2 OF 2 REV

NOTES:
UNLESS OTHERWISE SPECIFIED
1. FOR ASSEMBLY SEE 2200A-4003.
2. FOR SCHEMATIC DIAGRAM SEE 2200A-1003.

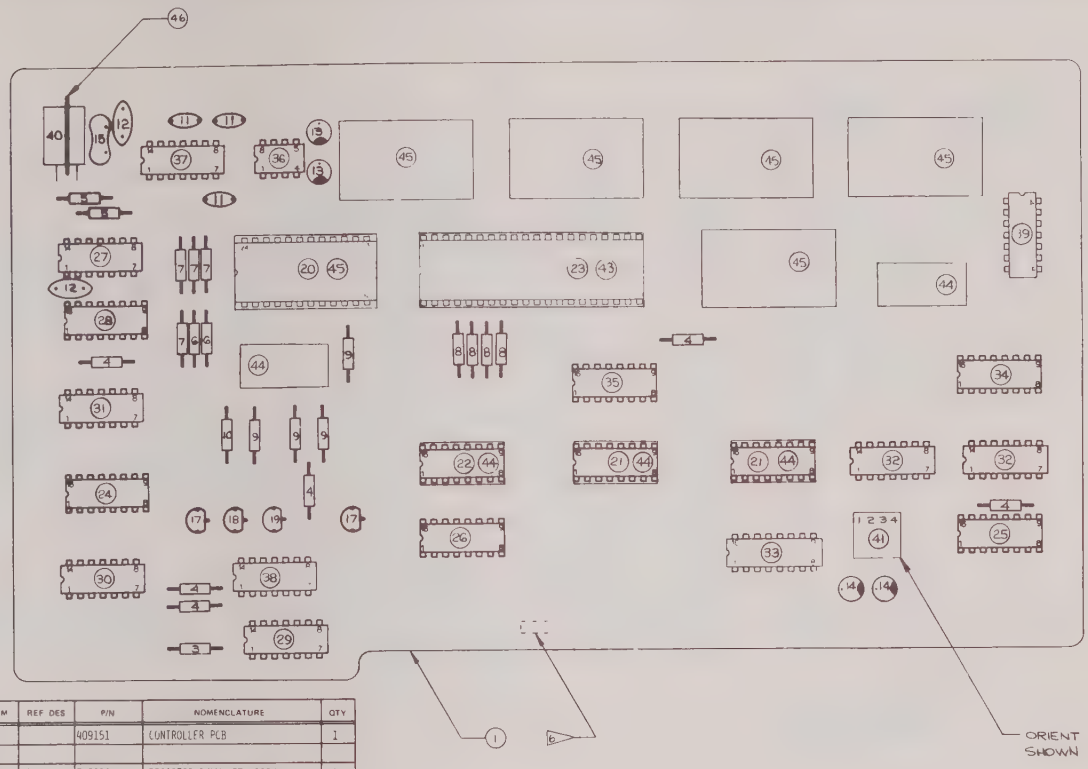


REF. DESIG.	DESCRIPTION	JOHN FLUKE PART NO.
U3 U4	ROM } may be installed in positions U3 or U4. Check part no. on IC ROM } before ordering replacement.	418541 418533
U5	Linearizer ROM; J, K, T, R, S	418517
U6	Not Used	
U11	Special Program ROM (2200A-4515T) (Specify four thermocouple types when ordering replacement part)	432757
U12	Temperature Configuration PROM (2200A-4506T) (Specify four thermocouple types when ordering replacement part)	432666

RELEASED TO PRE-PROD
RELEASED TO PILOT RUN

JOHN FLUKE MFG CO INC
P.O. BOX 7428 SEATTLE WA.
89536
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES
TOLERANCES
DR M. BROWN 2/3/75
CHK L. MOREY 2-10-75
ENG Richard Pearson 2-11-75
MATERIAL
FINISH

CONTROLLER REFERENCE DESIGNATION DRAWING
PART NO. | SIZE D | DRAWING NO. 2200A-1603
SCALE 2/1 | SHT | OF | REV —



ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409151	CONTROLLER PCB	1
2				
3	R20	348920	RESISTOR 1/4W, 5%, 100K	1
4	7	343426	RESISTOR, 1/4W, 5%, 1K	6
5	R1, 2	148115	RESISTOR, 1/4W, 5%, 820	2
6	R4, 5	148080	RESISTOR, 1/4W, 5%, 5.6K	2
7	8	193474	RESISTOR, 1/4W, 5%, 110Ω	4
8	9	343434	RESISTOR, 1/4W, 5%, 470Ω	4
9	10	348839	RESISTOR, 1/4W, 5%, 10KΩ	4
10	R14	386490	RESISTOR, 1/4W, 5%, 2.7K	1
11	C4,C3,1	335786	CAPACITOR .01uF	3
12	C9,10	168435	CAPACITOR .025uF	2
13	C5, C6	364216	CAPACITOR 2.2uF	2
14	C7, C8	193623	CAPACITOR 10uF	2
15	C2	277210	CAPACITOR 51PF	1
16				
17	Q1,4	218081	TRANSISTOR MPS6520	2
18	Q2	229898	TRANSISTOR MPS6522	1
19	Q3	159855	TRANSISTOR, CS23030	1
20	U9	404418	I.C. 4040P	1
21	U20,21	404442	I.C. 4002-1	2
22	U19	404467	I.C. 4002-2	1
23	U10	404434	I.C. 4089	1
24	U18	355230	I.C. 4027	1
25	U28	376962	I.C. 22K	1
26	U26	381848	I.C. CD4049AE	1
27	U7	363580	I.C 74S00A	1
28	U6	340463	I.C. 74163N	1
29	U29	355206	I.C. 4012	1
30	U24	355180	I.C 4025	1
31	U13	355172	I.C. 4001	1
32	U22,23	394536	I.C 74LS05	2
33	U27	407759	I.C. MM80C97N	1
34	U17	358119	I.C. 1K	1
35	U15	393009	I.C 74L42	1
36	U2	408867	I.C. MM0026CN	1
37	U1	418004	I.C. 74S04N	1
38	U25	364000	I.C. 10K	1
39	U14	387100	I.C. 4.7K	1
40	Y1	408518	CRYSTAL 5.185MHz	1
41	S1-4	408559	SWITCH, 4 SPST	1
42				
43		418988	SOCKET 40 PIN	1
44		276535	SOCKET 16 PIN	5
45		418970	SOCKET 24 PIN	6
46		422865	STRAP, RUBBER	1

△10 R9, 13, 16, 17
△9 R8, 10, 11, 12
△8 R6, 7, 18, 23
△7 R3, 15, 19, 21, 22, 24
△6 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177 OR EQUIVALENT).
5 CLEAN ASSEMBLY PER S.O.P. 89.4.
4 TRIM LEADS TO .100 MAX LONG
3 ASSEMBLE PER S.O.P. 111.8.
2 FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1603.
1. FOR SCHEMATIC DIAGRAM SEE 2200A-1003.
NOTES

REV	CHANGE DESCRIPTION
A	RELEASED TO PRE-PROD ITEM 45 WAS: 376236 ITEM 44 WAS: 387324 ITEM 43 WAS: 376244 REVISED LOCATION OF ITEMS 41, 43, 44 & 45 CALLOUTS RELEASED TO PILOT RUN

PROPRIETARY NOTICE

FLUKE 89536 — JOHN FLUKE MFG CO INC, P O BOX 7428 SEATTLE WA
DO NOT SCALE DRAWING DIMENSIONS IN INCHES
TOLERANCES: .xx ±.01, .xxx ±.010, ANGLES ±, 100 DIA ±.003 .002, 101 200 DIA ±.004 .002, 201 500 DIA ±.006 .003, 501 1.00 DIA ±.010 .005

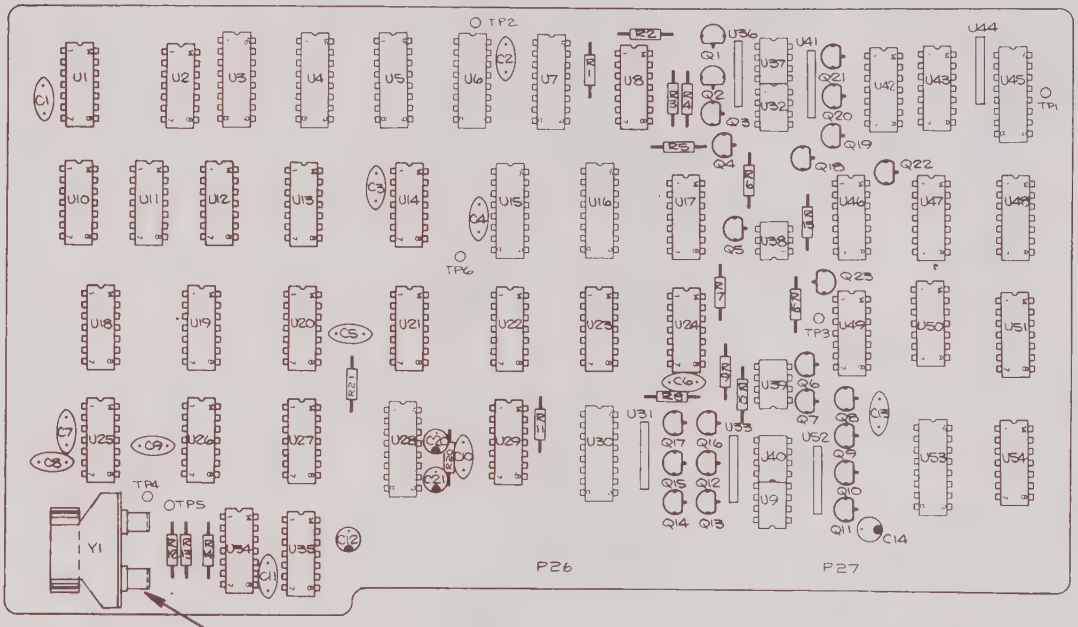
DR	M. BROWN	6-23-75
CHK	T. MOREY	7-10-75
ENG	[illegible]	7-11-75
ENG	Robert Berry	7-11-75
MATERIAL	SEE B/M	
FINISH	SEE NOTES	

CONTROLLER ASSY

PART NO.	SIZE	DRAWING NO.
406546	D	2200A-4003

SCALE 2/1 | SHT | OF | REV A

NOTES:
UNLESS OTHERWISE SPECIFIED
1. FOR ASSEMBLY SEE 2200A-4004
2. FOR SCHEMATIC DIAGRAM SEE 2200A-1004.



When ordering replacement part (Y1), specify part number which corresponds to line frequency indicated on 2240A rear panel decal.

50 Hz - P/N 408161 (2 MHz crystal)
60 Hz - P/N 408153 (2.4 MHz crystal)

RELEASED TO PRE-PROD
RELEASED TO PILOT RUN

FLUKE	JOHN FLUKE MFG CO INC, P O BOX 7428 SEATTLE WA
89536	DO NOT SCALE DRAWING, DIMENSIONS IN INCHES
DR	M. SHAVER
CHK	J. KOREY 7-10-5
ENG	SMB 7-10-5
ENG	Robert Brown 7-14-7
MATERIAL	
FINISH	

GUARD CROSSING REFERANCE DESIGNATION DRAWING

PART NO	SIZE	DRAWING NO
	D	2200A-1604

SCALE 2/1 SHT 1 OF 1 REV —

ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409169	GUARD CROSSING PCB	1
2				
3				
4				
5	[7]	148023	RESISTOR 1/4W, 5%, 1K	5
6	R2-5	193508	RESISTOR 1/4W, 5%, 3K	4
7	[5]	147967	RESISTOR 1/4W, 5%, 330Ω	3
8	R12,R13	148049	RESISTOR 1/4W, 5%, 2.2K	2
9	R15,R16	147934	RESISTOR 1/4W, 5%, 150Ω	2
10	R20	348870	RESISTOR 1/4W, 5%, 22K	1
11	R21	248807	RESISTOR 1/8W, 1%, 100K	1
12				
13				
14				
15	C20,C21	161331	CAPACITOR .22UF	2
16	[9]	175232	CAPACITOR .005UF	11
17	C12,C14	330662	CAPACITOR 10UF	2
18	C8	105593	CAPACITOR 100PF	1
19				
20				
21				
22				
23				
24				
25	Q1-Q23	218396	TRANSISTOR 2N3904	23
26				
27				

ITEM	REF DES	P/N	NOMENCLATURE	QTY
28				
29				
30	U31,U44	408310	IC RES-NETWORK, 1KΩ	2
31	U33,U41	408302	IC RES-NETWORK, 330Ω	2
32	U36,U42	408294	IC RES-NETWORK, 150Ω	2
33				
34				
35	[10]	387076	IC ILD 74	5
36	U38	380014	IC #MCT2	1
37	U49 U42	355172	IC #CD4001AC	2
38	U51,U54	363820	IC #CD4012AE	2
39	U48	355198	IC #CD4011AE	1
40				
41	[1]	340117	IC MC 14013L	5
42	U16	340125	IC #MC14015CP	1
43	U8	363838	IC #CD4016AE	1
44				
45	U52	355149	IC #CD4042AE	1
46	[3]	381848	IC #CD4049AE	3
47	U45	408211	IC #MC 14502CP	1
48				
49				
50	U11	393033	IC #SN74LS00N	1
51	U22,U25	393042	IC SN74LS02N	2
52	U23,U26	393058	IC #SN74LS04N	2
53				
54	U2	393066	IC #SN74LS08N	1

ITEM	REF DES	P/N	NOMENCLATURE	QTY
55	U12,U27	393074	IC #SN74LS10N	2
56				
57	U21	393090	IC #SN74LS27N	1
58				
59	U19,U29	393124	IC #SN4LS74N	2
60	U13	408237	IC #SN74LS86N	1
61				
62	U34	402545	IC #SN74LS90N	1
63				
64	[15]	393157	IC #SN4LS107N	6
65				
66	U28	404186	IC #SN74LS123NL	1
67				
68	U3	408203	IC #DM85L51N	1
69	U4-U7	408195	IC #DM85L52N	4
70				
71				
72				
73				
74				
75				
76		148668	CRYSTAL SOCKET	1

[13] U1, U10, U14, U18, U20 & U35.
[12] U15, U30 & U50.
[11] U17, U24, U43, U46 & U47.
[10] U32 , U37 , U39, U40 & U9
[9] C1-C7, C9-C11, & C13.
[8] R6, R9 & R10.
[7] R1, R7, R8, R11 & R14.
[6] MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED. JSING INKSTAMP (PERMA-DRI 177, OR EQUIVALENT).

5. CLEAN ASSEMBLY PER S.O.P. 89 4
4. TRIM LEADS TO .100 MAX. LONG
3. ASSY PER S.O.P. 111.8.
2. FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1604.
1. FOR SCHEMATIC DIAGRAM SEE 2200A-1004.

NOTES:

SEE SHEET 2 FOR ASSY. DWG.

REV	CHANGE DESCRIPTION	DR	CHK	APPR
	RELEASED TO PRE-PROD			
A	ITEM 37 QTY WAS: 1 CHANGED ITEM 11 WAS: 305346 CHANGED ITEM 10 WAS: 408114 DELETED ITEM 73, 74 & 75			
	RELEASED TO PILOT RUN			

PRELIMINARY NOTICE

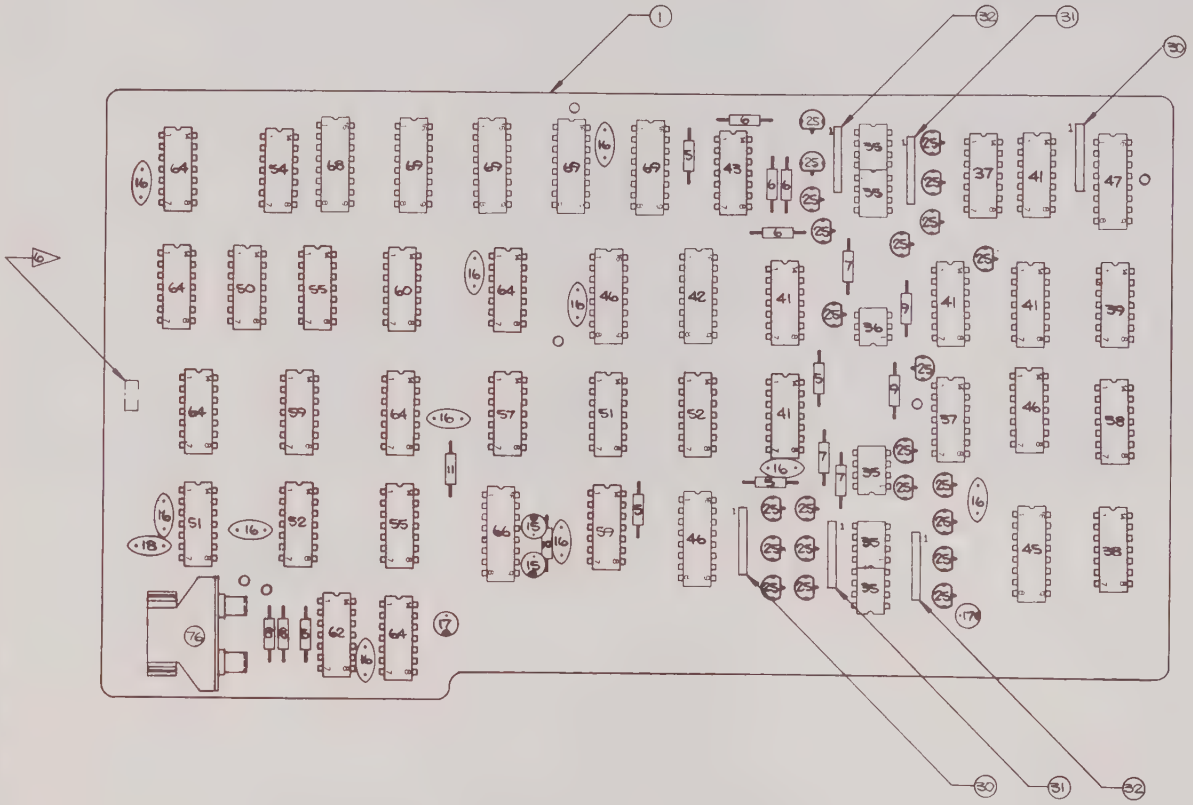
FLUKE | JOHN FLUKE MFG. CO., INC. P.O. BOX 7428 SEATTLE WA | 89536 | DO NOT SCALE DRAWING. DIMENSIONS IN INCHES | TOLERANCES

DR	U. SHAVER	6-24-5
CHK	T. MOREY	7-10-5
ENG	SHB	7-10-5
ENG		
MATERIAL		
FINISH		

GUARD CROSSING ASSEMBLY

PART NO	SIZE	DRAWING NO
406322	D	2200A-4004

SCALE 2/1 | SHT 1 OF 2 | REV A



SEE SHEET 1 FOR PARTS LIST

— SEE SH 1 FOR REV —

REV	CHANGE DESCRIPTION	DR	CHK	APPR

PROPRIETARY NOTICE

JOHN FLUKE MFG CO INC
P O BOX 7428 SEATTLE WA

89536

DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

TOLERANCES

XX ± .020	.000 .100 DIA	.001 .002	
XXX ± .010	.101 .200 DIA	.004 .002	
ANGLES ± —	.201 .500 DIA	.006 .003	
	.501 1.500 DIA	.010 .005	

DR	U. SHAVER	6.21.5
CHK	T. MOREY	7.1.05
ENG	[illegible]	7-1-05
ENG	[illegible]	7-1-05

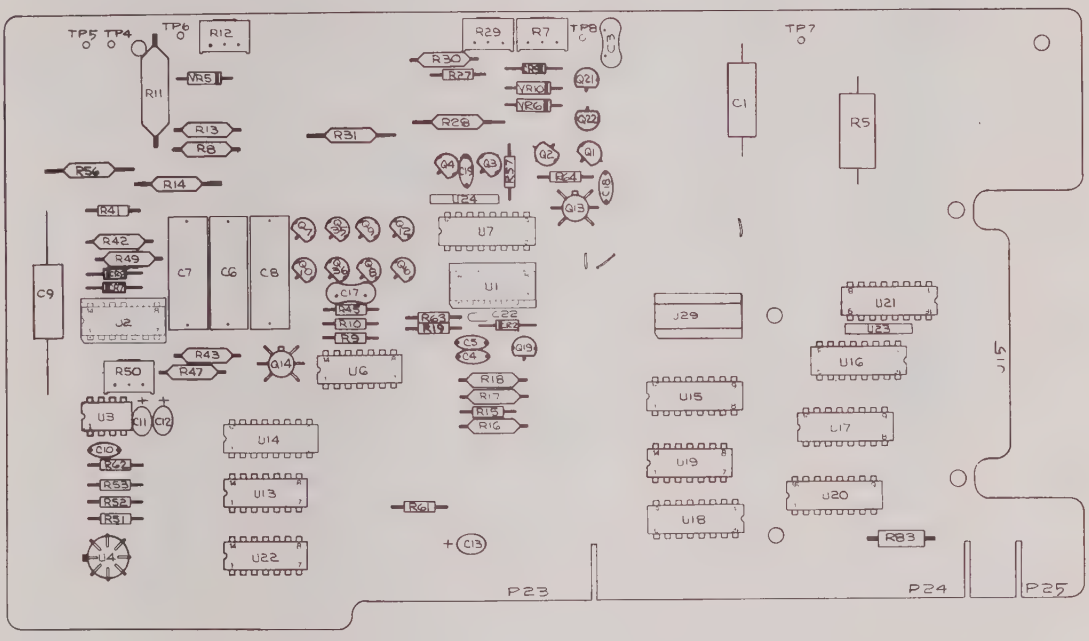
MATERIAL
SEE B/M SH 1

FINISH
SEE NOTES SH 1

GUARD CROSSING ASSEMBLY

PART NO	SIZE	DRAWING NO
406322	D	2200A-4004

SCALE 2/1 SHT 2 OF 2 REV A



FOR ASSEMBLY DRAWING SEE 2200A-4005
FOR SCHEMATIC DIAGRAM SEE 2200A-1005

REV	CHANGE DESCRIPTION	DR	CHK	APPR
A	ADDED R85, C22, TP's, Q35, Q36; REV U4 CONFIG	MB		
—	RELEASE TO PILOT	MB		

RELEASED TO PRE PROD

PROPRIETARY NOTICE

FLUKE — JOHN FLUKE MFG CO INC, P O BOX 7428 SEATTLE WA

89536

DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

TOLERANCES

XX ± .020	.500 - 100 DIA	.003	.001
XXX ± .010	.250 DIA	.004	.002
ANGLES ±	.100 DIA	.008	.003
	.050 DIA	.010	.007

DR	M BROWN	7-15-75
CHK	P ROBINSON	8-11-75
ENG		8/7/75
ENG		8/20/75
MATERIAL		
FINISH		

10 uV A/D
REFERENCE DESIGNATION DWG

PART NO	SIZE	DRAWING NO
	D	2200A-1605

SCALE 2/1 SHT 1 OF 1 REV A

ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409177	PCB, A-D	1
2	U1 & 2	404087	IC RC4739DP	2
3	U5	352195	IC #311	1
4	U4	419044	IC #4195T	1
5	Q13 & 14	379321	TRANSISTOR, DUAL FET #E 7024	2
6	7	357905	TRANSISTOR, J-FET #F2690	12
7	Q6 & 7	376475	TRANSISTOR, FET	2
8	Q19	218396	TRANSISTOR 2N3904	1
9	11	203323	DIODE IN4148	4
10	VR 6 & 10	277236	DIODE ZENER, IN752A 5.6V	2
11	8	377283	ZENER REFERENCE SET	1
12				
13	12	412742	IC 74C173	4
14	U19	418798	IC #4048	1
15	U20	380741	IC CD4028	1
16	U21	381830	IC #4050AE	1
17	U13	393157	IC 74LS107	1
18	U14	393165	IC 74LS139	1
19	U22	393033	IC 74LS00	1
20				
21	U6	412759	IC DM8819	1
22	U7	413237	IC ULN-2003A	1
23	C1 & 9	363085	CAP, 0.47UF, 10% 50V	2
24	C6, 7 & 8	306522	CAP, 2.2UF, 100V	3
25	9	105692	CAP, 500VDCW, 10%, 500PF	4
26	C10	106211	CAP, 600VDCW, .0027UF	1
27	C11,12&13	330662	CAP, 10UF, 20V, 20%	3

28	C3 & 17	190397	CAP 4PF, 500 WVDC	2
29	R30	217984	RES 1/8W 402K	1
30	R28, R31	416347	RES KIT 1/8W 20.0K, 2.22K	1
31				
32	R14 & 56	416339	RES KIT 20K & 40K	1
33	R12	291120	RES., VAR. 500Ω+/-10%	1
34	R61 & R64	147985	RES 1/4W, 5%, 470Ω	2
35	R49 & 47	291443	RES, 1/8W, 1%, 75.0K	2
36	R16	188367	RES, 1/8W, 1%, 23.7K	1
37	R17 & 18	285296	RES, 1/8W, 15KΩ, 1%	2
38	R42 & 43	268417	RES, 6.81K 1/8W 1%	2
39	R62	149484	RES 1/4W 82Ω	1
40	R27	208389	RES 1/4W 5% 3.3 MEG.	1
41	R8	277137	RES, 2K, 1%, 1/8W	1
42	R5	424721	RES, 2W, 10%, 39K	1
43	10	148130	RES, 1/4W, 5%, 22K	6
44	R52	188433	RES, 1/4W, 5%, 680K	1
45	R51	220541	RES, 820K 1/4W 5%	1
46	R41	148049	RES, 1/4W, 5%, 2.2K	1
47	R53	148031	RES, 1/4W, 5%, 1.5K	1
48	R29	285163	RES, VAR 2K	1
49	U23 & 24	412726	RES, 100K, 5%, 1/8W	2
50	R50	285148	RES, 200Ω, 10%, POT	1
51	R7	288290	RES, 50K+/-10% POT	1
52	R83	190520	RES, 100 MEG, 1/2W, 5%	1
53	R63	148023	RES. 1/4W 5%. 1K	1
54	C22	255471	CAP, 0.005uF	1
55	U29	387316	SOCKET 14 PIN	3
56		115469	WIRE, COPPER #22 AWG	.25
57	TP4-8	267500	CONNECTOR POST	5

3 CUT (56) INTO THREE 1" PIECES & INSTALL JUMPER WIRE AS SHOWN.
11 U15, U16, U17 & U18
11 CR2, 7, 8 & 9
10 R9, 10, 15, 19, 45 & 57
9 C4, 5, 18 & 19
8 VR5, R11 & R13 ARE SUPPLIED AS A KIT.
7 Q1, 2, 3, 4, 8, 9, 10, 12, 21, 22, 35, 36.
6 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED, USING INKSTAMP (PERMA-DRI 177, OR EQUIV.)

5. CLEAN ASSEMBLY PER S.O.P. 89.4.
4. TRIM LEADS TO .100 MAX LONG
3. ASSEMBLE PER S.O.P. 111.8.
2. FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1605.
1. FOR SCHEMATIC DIAGRAM SEE 2200A-1005.

NOTES:

SEE SHEET 2 FOR ASSEMBLY DWG

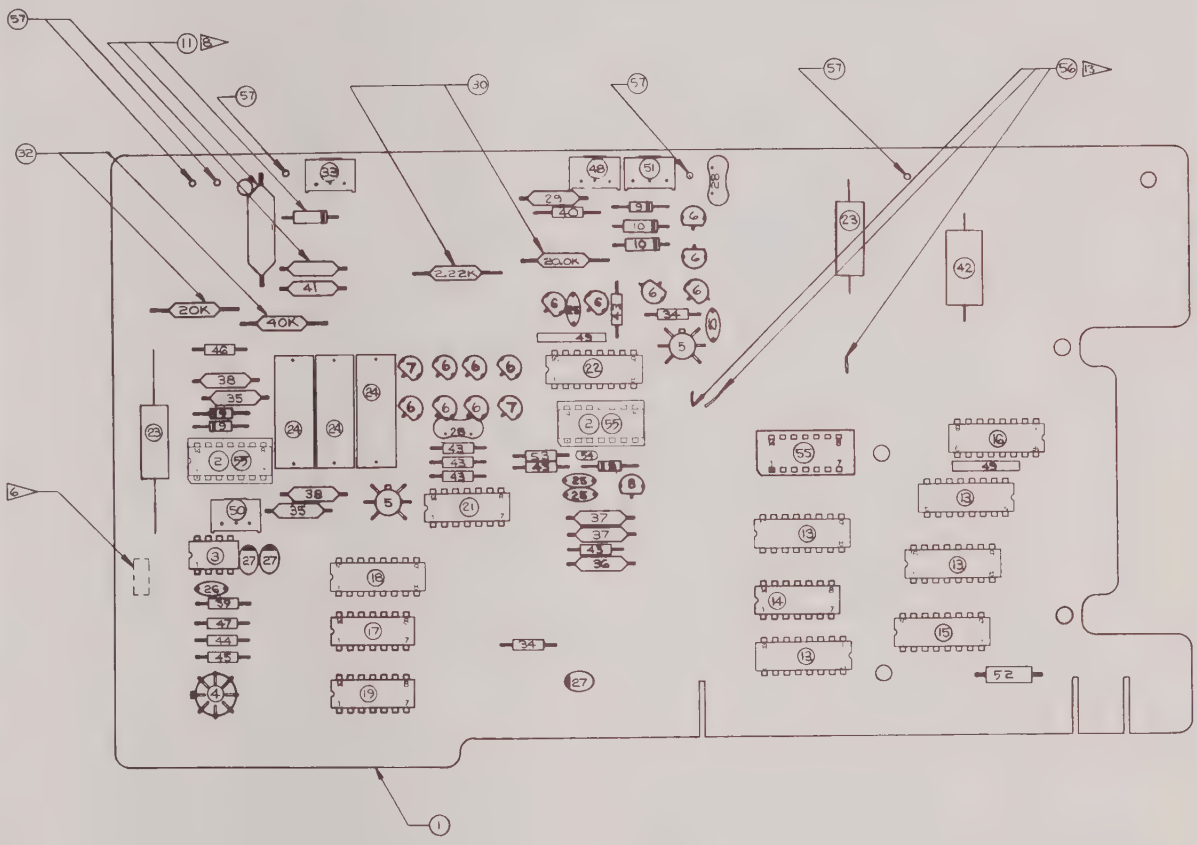
REV	DESCRIPTION	BY	CHK	APPR
A	RELEASED TO PRE PROD ITEM 48 WAS 285155; ITEM 50 WAS 275743; ITEM 57 WAS 277418, ADDED ITEMS 5254; ITEM 4 WAS 363861; ITEM 6 QTY WAS 10, ITEM 29 WAS 375931; ITEM 30 WAS 112045; ITEM 31 WAS 111906; ITEM 34 WAS 188441, ITEM 39 WAS 148041; ITEM 40 WAS 194944; ITEM 42 WAS 110015	GS		
—	RELEASE TO PILOT			

FLUKE — JOHN FLUKE MFG CO INC, P.O. BOX 7428 SEATTLE WA 89536
DO NOT SCALE DRAWING. DIMENSIONS IN INCHES
TOLERANCES
MATERIAL
DRN M. MOREY 7/21/75
CHK E. COLEMAN 8/6/75
ENG 8/7/75
ENG 9/16/75

10 MV A/D ASSEMBLY

PART NO	SIZE	DRAWING NO
409342	D	2200A 4005

SCALE 2/1 SHT 1 OF 2 REV A



SEE SHEET 1 FOR PARTS LIST & NOTES

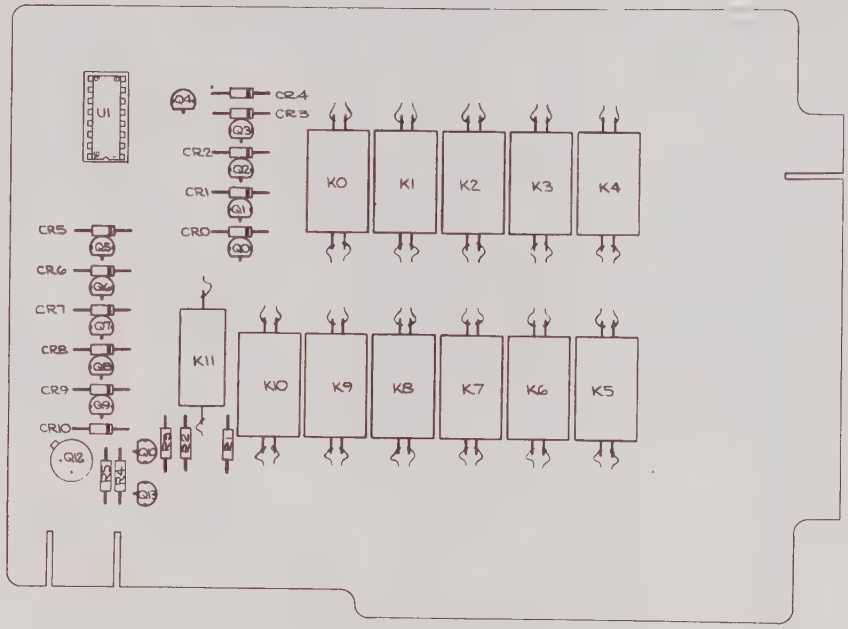
— SEE SH 1 FOR REV —

REV	CHANGE DESCRIPTION	DR	CHK	APPR

FLUKE	JOHN FLUKE MFG CO. INC P O BOX 7428 SEATTLE WA	DR T. MOSEY 7-7-75 CHK F. EDELMAN BHM	10uV A/D PCB ASSEMBLY
89536	DO NOT SCALE DRAWING DIMENSIONS IN INCHES	ENG BHM ENG	
TOLERABLES		MATERIAL	
		FINISH	

PART NO	SIZE	DRAWING NO.
409342	D	2200A-4005
SCALE 2X	SHT 2 OF 2	REV A

NOTES:
UNLESS OTHERWISE SPECIFIED
1. FOR ASSEMBLY SEE 2200A-4006.
2. FOR SCHEMATIC DIAGRAM SEE 2200A-1006.



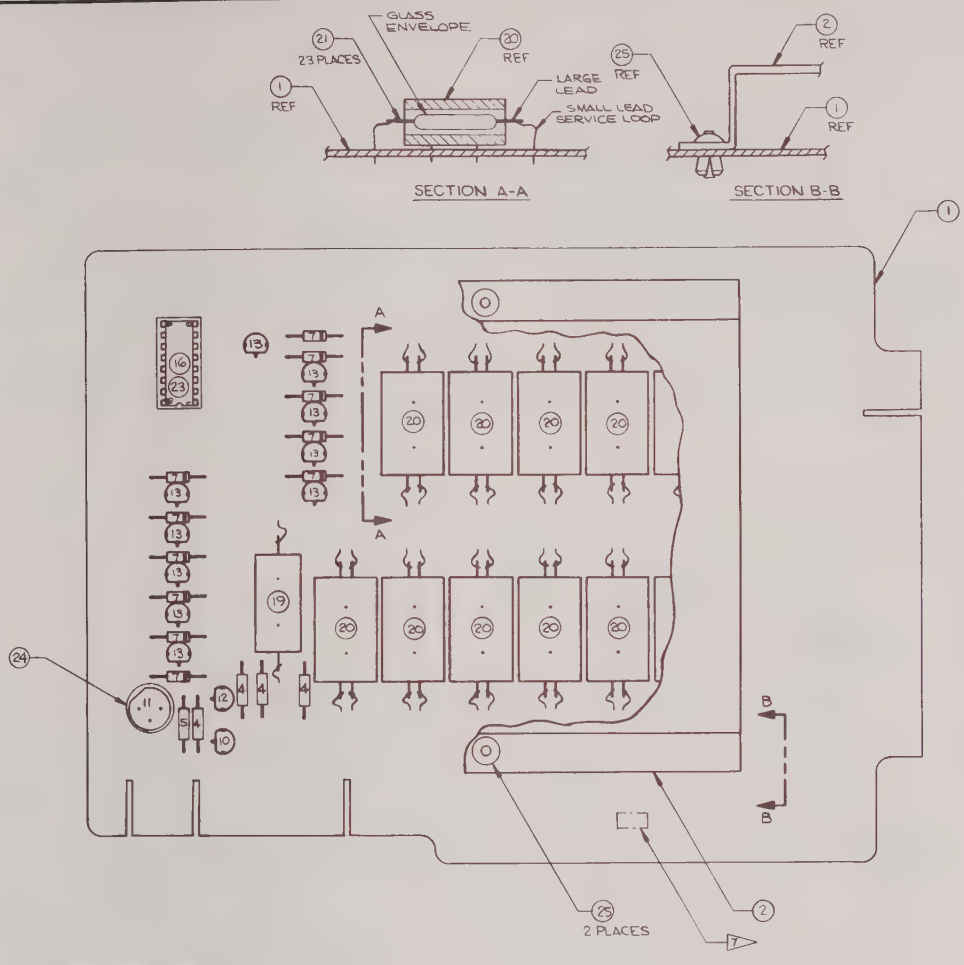
RELEASED TO PRE-PROD
RELEASED TO PILOT

FLUKE 845.36

MOREY
EDELMAN
SB

REF. DES. DWG.
10μV SCANNER

D 2200A-1606



ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409185	10 uV SCANNER PCB	1
2		371542	SCANNER COVER	1
3				
4	R1-R4	147983	RESISTOR 1/4 W, 5%, 470 OHM	4
5	R5	148106	RESISTOR 1/4W, 5%, 10K	1
6				
7	CR0-CR10	203323	DIODE 1N4148	11
8				
9				
10	Q13	218396	TRANSISTOR 2N3904	1
11	Q12	182196	TRANSISTOR 2N3643	1
12	Q10	352112	N-CHANNEL J-FET	1
13	Q0-Q9	195974	TRANSISTOR 2N3906	10
14				
15				
16	U1	407981	I.C. MM 74C42N	1
17				
18				
19	K11	269019	SINGLE COIL U6P	1
20	K0-K10	272070	DOUBLE COIL UD6P	11
21		414300	REED SWITCH	23
22				
23		276535	SOCKET 16 PIN	1
24		152207	TRANSISTOR MOUNTING SPACER	1
25		100941	PLASTIC RIVET	2

8. TO PREVENT FIELD FAILURES WHICH ARE NOT DETECTABLE IN TEST, HANDLE (21) AS FOLLOWS. DO NOT BEND LARGE LEADS WHICH ENTER THE GLASS ENVELOPE. REED SWITCH UNUSABLE IF LARGE LEADS ARE BENT. MAKE SERVICE LOOP IN SMALL LEAD WHICH ATTACHES TO PCB PRIOR TO SOLDERING. RETURN (21) TO VENDOR IF SMALL LEAD BECOMES DETACHED FROM SWITCH. (SEE SECTION A-A)

7 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED, USING INKSTAMP (PERMA-DRI 177 OR EQUIVALENT).

6. SPECIAL CLEANING REQUIREMENTS
PRIOR TO ATTACHING ITEM (2) FINAL WASH ASSY TO REMOVE SALTS PER 6.2.5 OF S.O.P. 89.16. AFTER WASH HANDLE ASSY SUCH THAT CIRCUITRY NOT BE HANDLED WITH BARE HANDS. PACKAGE ASSY IN PLASTIC BAGS OR EQUIVALENT TO PREVENT LATER CONTAMINATION.

5. TRIM LEADS TO .050 MAX. LONG

4. ASSEMBLE PER S.O.P. 111.8.

2. FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1606.

1. FOR SCHEMATIC DIAGRAM SEE 2200A-1006.

NOTES

REV	CHANGE DESCRIPTION	DR	CHK	APPR
A	RELEASED TO PRE-PROD DELETED NOTE 4 WAS: HAND SOLDER ITEM 21.. ADDED ITEM 23 REVISED SECTION A-A COMPLETELY REV NOTE 6 & 8	BM 5/15/85	RF 8/14/85	RF 8/14/85
—	RELEASED TO PILOT	EM 7/25/84	RF 8/4/84	RF 8/4/84

PROPRIETARY NOTICE

FLUKE 89536 — JOHN FLUKE MFG CO., INC, P O BOX 7428 SEATTLE WA

DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

TOLERANCES

DR T MOREY 5/15/85
CHK F EDELMAN 8/4/85
ENG JE 8-4-85
ENG [illegible] [illegible]

MATERIAL

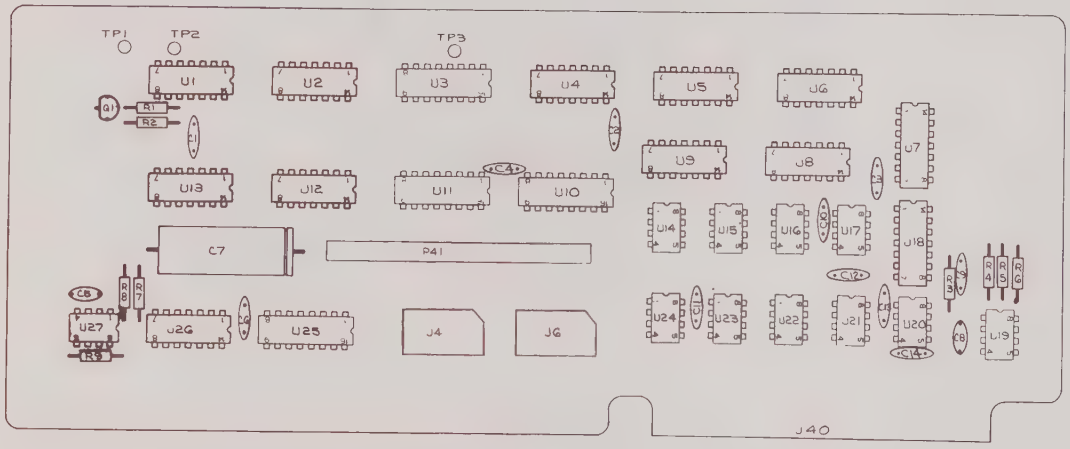
FINISH

10 uV SCANNER ASSY

PART NO. 406330 | SIZE D | DRAWING NO. 2200A-4006

SCALE 2/1 | SHT 1 OF 1 | REV A

NOTES:
UNLESS OTHERWISE SPECIFIED:
1. FOR ASSEMBLY SEE 2200A-4007.
2. FOR SCHEMATIC DIAGRAM SEE 2200A-1007.



REV	CHANGE DESCRIPTION	DR	CHK	APP'D
A	ADDED TP1,2,3			
—	RELEASED TO PILOT			

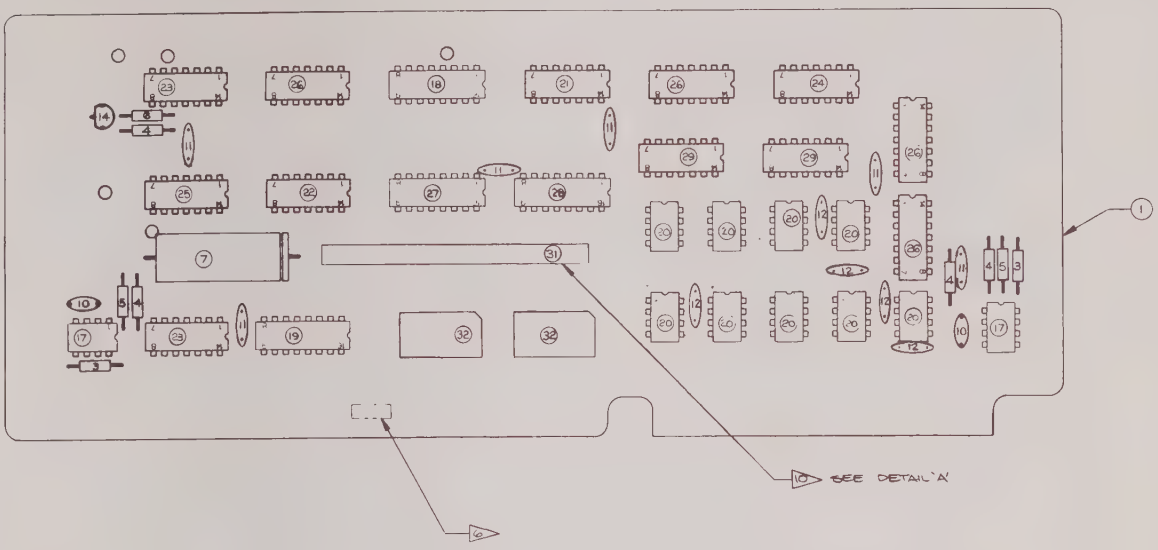
RELEASED TO PRE PROD

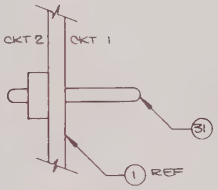
JOHN FLUKE MFG CO INC
P.O. BOX 7428 SEATTLE WA
89536
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

DR M BROWN 2375
CHK T. MCKEY 2275
ENG [illegible] 7-11-75
MATERIAL
FINISH

PRINTER DRIVE REFERENCE DESIGNATION DRAWING

PART NO. —
SIZE D
DRAWING NO 2200A-1607
SCALE 2/1
SHT 1 OF 1
REV A





DETAIL 'A'
SCALE - NONE

ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409193	PRINTER DRIVE PCB	1
2				
3	R3, 6	202879	RESISTOR, 1/4W, 5%, 2K	2
4	R2,7,4,3	148023	RESISTOR, 1/4W, 5%, 1K	4
5	R5, 8	159731	RESISTOR, 1/4W, 5%, 12K	2
6	R1	193342	RESISTOR, 1/4W, 5%, 5.1K	1
7	C7	187765	CAPACITOR, 330uF	1
8				
9				
10	C5, C8	149153	CAPACITOR .01uF	2
11	7	149161	CAPACITOR .05uF	6
12	8	168435	CAPACITOR .025uF	5
13				
14	Q1	218396	TRANSISTOR 2N3904	1
15				
16				
17	U27, 19	352195	I.C. 311	2
18	U3	414029	I.C. SN74LS112	1
19	U25	407759	I.C. MM80C97N	1
20	9	329706	I.C. SN75452P	9
21	U4	393090	I.C. SN74LS27	1
22	U12	393074	I.C. 74LS10	1
23	U1, 26	393058	I.C. 74LS04	2
24	U6	393041	I.C. SN74LS02	1
25	U13	393033	I.C. 74LS00	1
26	U2,5,7,18	393124	I.C. 74LS74	4
27	U11	355214	I.C. 4009	1
28	U10	355412	I.C. 4010	1
29	U9, 8	408732	I.C. 74LS164N	2
30				
31		424135	PIN, CONTACT 09-64-1152	1
32		276527	SOCKET, I.C. 133-51-02-003	2

10 HAND SOLDER ITEM 31 AFTER FLOW SOLDERING.
9 U14, 15, 16, 17, 20, 21, 22, 23, 24
8 C 10, 11, 12, 13, 14
7 C1, 2, 3, 4, 6, 9
6 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177 OR EQUIVALENT).
5. CLEAN ASSEMBLY PER S.O.P. 89.4.
4 TRIM LEADS TO .10 MAX LONG
3. ASSEMBLE PER S.O.P. 111.8.
2 FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1607.
1. FOR SCHEMATIC DIAGRAM SEE 2200A-1007
NOTES

REV	CHANGE DESCRIPTION	DR	CHK	APP'D
B	DELETED PER S.O.P 89.19 FROM NOTE 4	BM 6-23-75	RR 6-21-75	RR 6-21-75
	RELEASED TO PRE-PROD	BM 6-23-75	RR 6-21-75	RR 6-21-75
A	ITEM 31 WAS: 414450 ITEM 32 WAS: 387316 ADDED DETAIL 'A'	BM 7-11-75	RR 7-11-75	RR 7-11-75
—	RELEASED TO PILOT	RAB 7-11-75	RR 7-11-75	RR 7-11-75

PROPRIETARY NOTICE

FLUKE 89536 JOHN FLUKE MFG CO., INC P.O. BOX 7428 SEATTLE WA

DO NOT SCALE DRAWING DIMENSIONS IN INCHES

TOLERANCES

DR M BROWN 6-23-75
CHK T MOREY 6-21-75
ENG RR 6-21-75
ENG 7-11-75
MATERIAL
FINISH

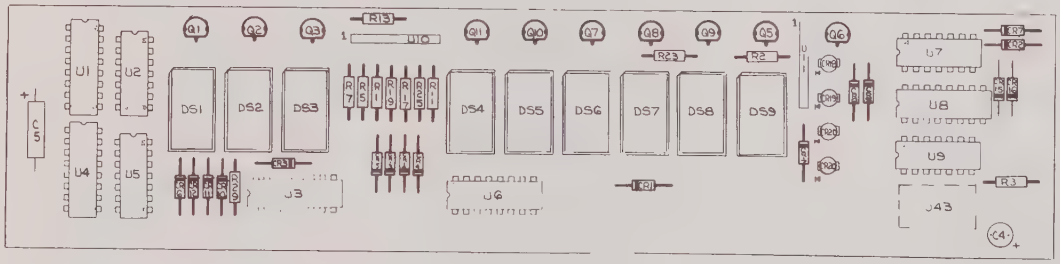
PRINTER DRIVE ASSY

PART NO. 406348 | SIZE D | DRAWING NO. 2200A-4007 | REV

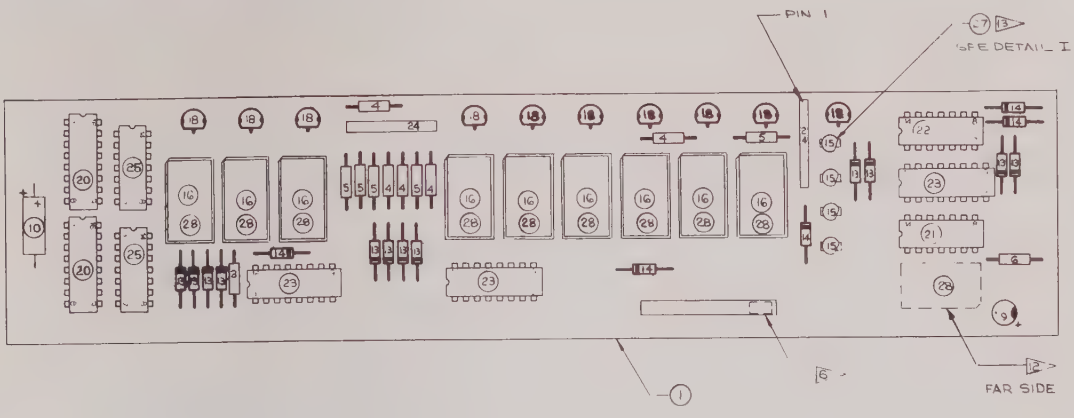
SCALE 2/1 SHT 1 OF 1

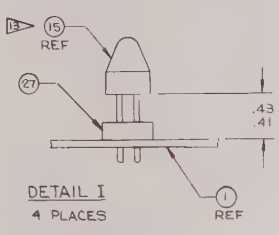
NOTES:
UNLESS OTHERWISE SPECIFIED:

1. FOR ASSEMBLY SEE 2240A-4008.
2. FOR SCHEMATIC DIAGRAM SEE 2240A-1008.

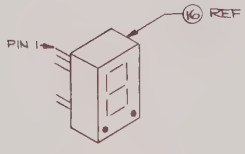


FLUKE	JOHN FLUKE MFG CO INC	DR M. BROWN	RELEASED TO PRE-PROD
89536	P.O. BOX 7428 SEATTLE WA	CHK T. MOREY 6-27-75	RELEASED TO PILOT
	DO NOT SCALE DRAWING DIMENSIONS IN INCHES	ENG [illegible] 6-30-75	DISPLAY REFERENCE DESIGNATION DRAWING
	TOLERANCES	ENG Robert Berry 7-11-75	PART NO — SIZE D DRAWING NO 2240A-1608
		MATERIAL	SCALE 2/1 SHT 1 OF 1 REV —
		FINISH	





DETAIL I
4 PLACES



DETAIL II
(NO SCALE)

ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409201	DISPLAY PCB	1
2				
3	R9	414524	RESISTOR 1/4W, 5%, 33	1
4	9	414540	RESISTOR, 1/4W, 5%, 51	9
5	8	414532	RESISTOR, 1/4W, 5%, 68	5
6	R3	368761	RESISTOR, 1/4W, 5%, 6.8K	1
7				
8				
9	C4	163915	CAPACITOR, 39uFD	1
10	C5	182832	CAPACITOR, 33uFD	1
11				
12				
13	2	203323	DIODE 1N4148	12
14	10	313247	DIODE #5082 - 2811	5
15	LR1,6-R,1	309617	LED FLV102	4
16	DS1-DS9	418012	DISPLAY, SEVEN SEGMENT	9
17				
18	1	352369	TRANSISTOR 2N4403	10
19				
20	U1, U4	340109	I C SN7447	2
21	U9	364018	I.C. 33	1
22	U7	393041	I.C. 74LS02	1
23	U3,U6,U8	293175	I C. 74145	3
24	U10, U11	414557	I.C .K	2
25	C5, U2	344069	I.C. 60	2
26				
27		427641	SOCKET, MODIFIED	4
28	J 43	276527	SOCKET, I.C.	10
29				
30				

13 TRIM LEADS ON ITEM 15 TO .40/.42 INSTALL AND AFTER SOLDERING.

12 HAND SOLDER ITEM 28 FAR SIDE ONE PLACE AFTER SOLDERING.

11 Q1, 2, 3, 9-11

10 LR1-3, 7, 17

9 LR4-6, 8-14

8 R1, 2, 5, 7, 25

7 R11, 13, 19, 17, 23

6. MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177 OR EQUIVALENT)

5. CLEAN ASSEMBLY PER S.O.P. 69.4

4. TRIM LEADS TO .100 MAX LONG

3 ASSEMBLE PER S.O.P. 111.8.

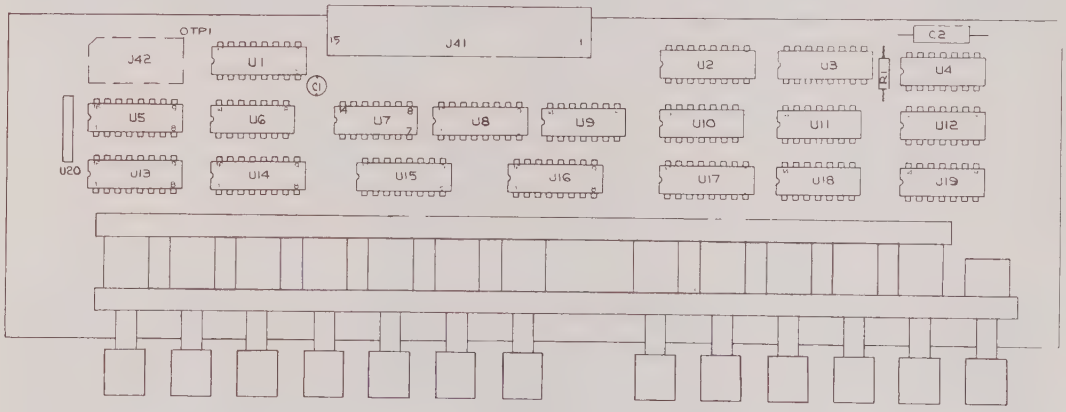
2 FOR REFERENCE DESIGNATION DRAWING SEE 2240A-1608.

1. FOR SCHEMATIC DIAGRAM SEE 2240A 1008.

NOTES

REV	REVISION NOTICE	ENG	DR
B	RELEASED TO PRE-PROD REV WORDING ON NOTE 12&13 NOTE 4 WAS: PER SOP 89.9 ADDED ITEM 27 & NOTE 13 ITEM 14 WAS: 149187 ITEM 28 WAS: 387316 INDIVIDUALLY IDENTIFIED (28)	RM 8/2	MB
A	CORRECTED DWG ERROR TWO ITEM 13 WAS ITEM 12 RELEASED TO PILOT	RM 7/25	MB

FLUKE 89536	JOHN FLUKE MFG. CO. INC P.O. BOX 7428 SEATTLE WA	DR M. BROWN 6-17-75	DISPLAY ASSY
	DO NOT SCALE DRAWING DIMENSIONS IN INCHES	CK T MOREY 6-27-75	
	TOLERANCES	ENG MB 7-7-75	
		MATERIAL	
		FINISH	PART NO. 406579 SIZE D DRAWING NO. 2240A-4008
			SCALE 2/1 SHT 1 OF 1 REV B

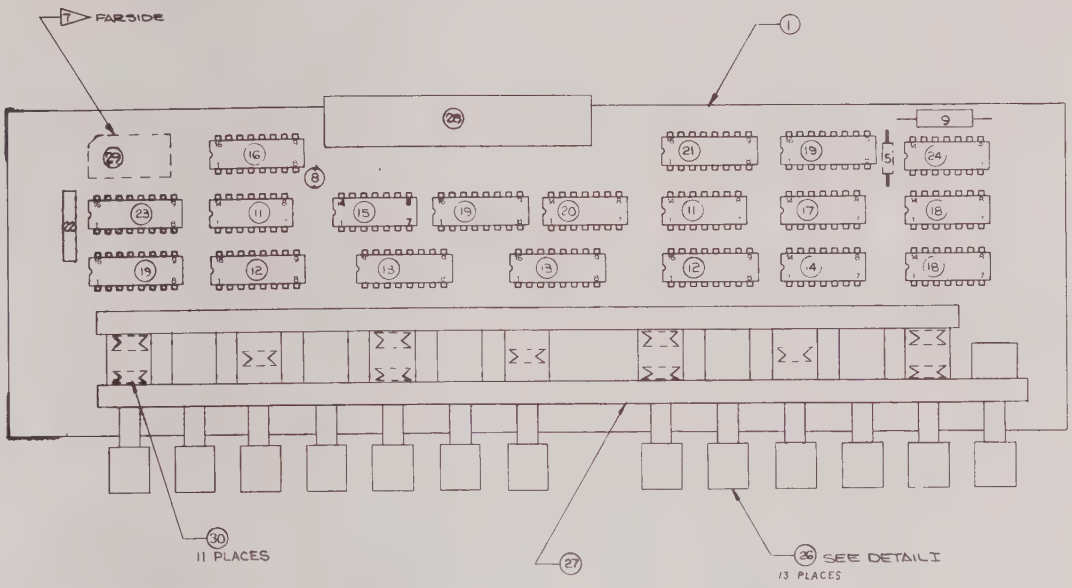


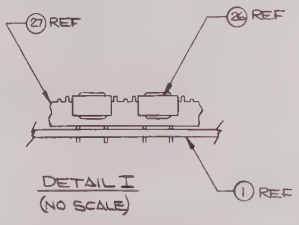
RELEASED TO PRE PROD	
A	ADDED TP1
RELEASED TO PILOT	

FLUKE 89536

MODE SWITCH REFERENCE DESIGNATION DRAWING

D 2240A-1609





DETAIL I
(NO SCALE)

ITEM	REF DES	P/N	NOMENCLATURE		QTY
1		409219	MODE SWITCH, PCB		1
2					
3					
4					
5	R1	348896	RESISTOR 1/4W, 5%, 47K		1
6					
7					
8	C1	357780	CAPACITOR 22uFD, 20V		1
9	C2	106054	CAPACITOR .0047uF		1
10					
11	U6, 10	352054	I.C.	760-3-15K OHM	2
12	U14, U17	381830	I.C.	4050A	2
13	U15, U16	407759	I.C.	MM80C97	2
14	U18	355172	I.C.	4001	1
15	U7	363820	I.C.	4002	1
16	U1	393231	I.C.	74LS193	1
17	U11	393157	I.C.	74LS107	1
18	U12, U19	393033	I.C.	74LS00	2
19	U13,U8,3	361848	I.C.	CD4049A	3
20	U9	408575	I.C.	CD4075B	1
21	J2	355230	I.C.	4027	1
22	U20	408310	I.C.	750-61-1K OHM	1
23	U5	408563	I.C.	7489	1
24	U4	293134	I.C.	9601	1
25					
26		412163	PUSHBUTTON		13
27		408526	SWITCH	2240A-8001	1
28	J41	414375	CONNECTOR	09-52-3151	1
29	J42	387316	SOCKET		1
30		295246	SPACER	.64286	11

HAND SOLDER ITEM 29 AFTER FLOW SOLDERING. (FARSIDE)

6. MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177 OR EQUIVALENT).

5. CLEAN ASSEMBLY PER S.O.P. 89.4.

4. TRIM LEADS TO .100 MAX. LONG

3. ASSEMBLE PER S.O.P. 111.8.

2. FOR REFERENCE DESIGNATION DRAWING SEE 2240A-1609.

1. FOR SCHEMATIC DIAGRAM SEE 2240A-1009.

NOTES:

REV	CHANGE DESCRIPTION	DR	CHK	APPR
B	ADDED DETAIL I NOTE 4 WAS PER SOP.			
	RELEASED TO PRE-PROD			
A	REVISED (28) & (23) CALLOUT			
	RELEASED TO PILOT			

FLUKE 89536

JOHN FLUKE MFG CO., INC
P.O. BOX 7428 SEATTLE WA

DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

TOLERANCES

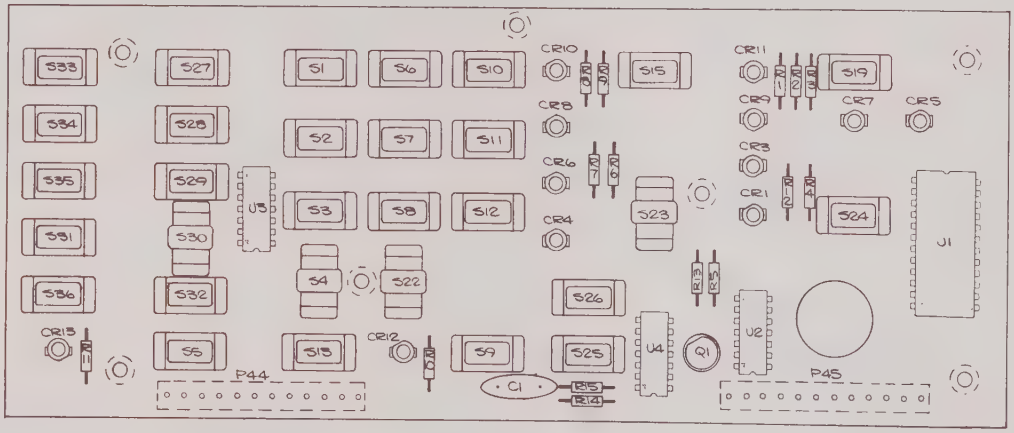
DR M. BROWN 6-10-76
CHK [illegible] 6/17/76
ENG [illegible] 6-30-76
MATERIAL SEE B/M
FINISH SEE NOTES

MODE SWITCH ASSY

PART NO	SIZE	DRAWING NO
406587	D	2240A-4009

SCALE 2/1 SHT 1 OF 1 REV B

NOTES:
UNLESS OTHERWISE SPECIFIED
1. FOR ASSEMBLY SEE 2240A-4011.
2. FOR SCHEMATIC DIAGRAM SEE 2240A-1011.



RELEASED TO PRE PROD			
A	DELETED S14		
RELEASED TO PILOT RUN			
REV.	CHANGE DESCRIPTION	DR	CHK

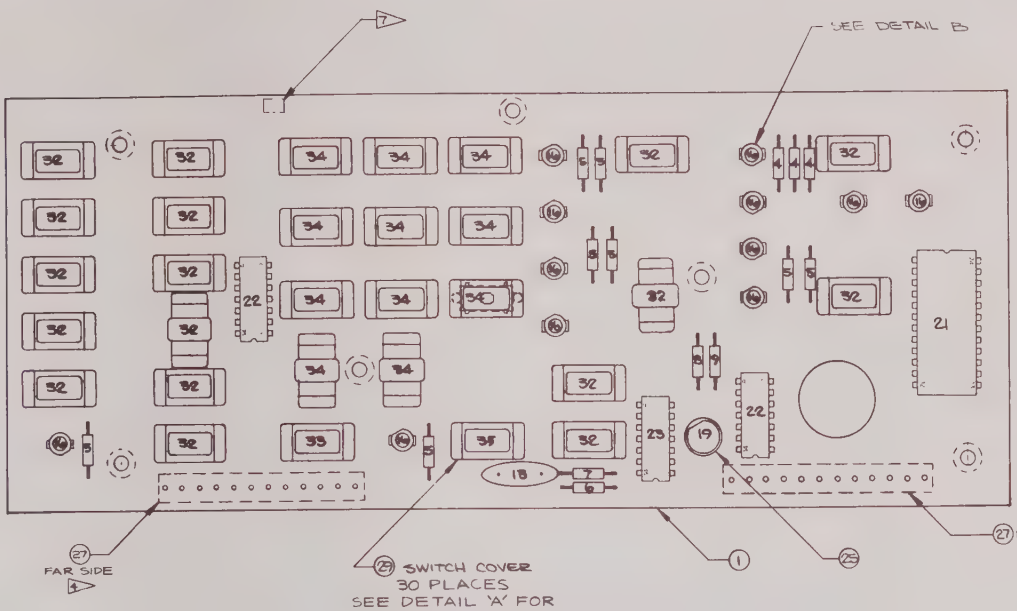
JOHN FLUKE MFG CO INC
P.O. BOX 7428 SEATLE WA
89536
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES
TOLERANCES

DR	K. SHAVER	6-6-78
CHK	T. MOZEY	7-11-78
ENG	TCP	7-11-78
ENG		7-11-78
MATERIAL	N/A	
FINISH	N/A	

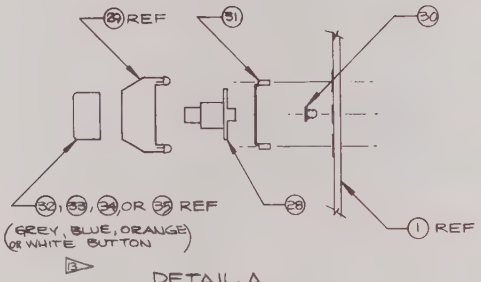
REF. DES. DWG.,
KEYBOARD
SWITCH

PART NO	SIZE	DRAWING NO
	D	2240A-1611

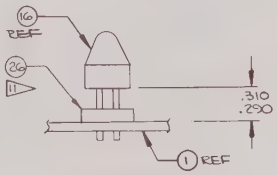
SCALE 2/1 SHT OF REV A



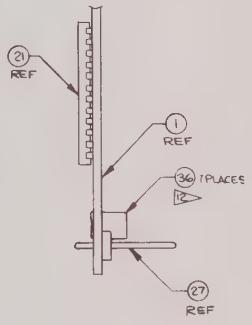
PUSH BUTTON CAPS (32) MUST BE SECURELY ATTACHED TO TOTAL ASSEMBLY.



DETAIL A
SWITCH ASSEMBLY
SCALE : 2/1



DETAIL B
12 PLACES



ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		407155	KEYBOARD SWITCH PCB	1
2				
3				
4	R1,2,3	159731	RESISTOR, 1/4W, 5%, 12K	3
5	R4, 6-12	147926	RESISTOR, 1/4W, 5%, 100 OHM	8
6	R14	194944	RESISTOR, 1/4W, 5%, 10 MEG	1
7	R15	221945	RESISTOR, 1/4W, 5%, 2.4 MEG	1
8	R13	160796	RESISTOR, 1/4W, 5%, 8.2K	1
9	R5	148007	RESISTOR, 1/4W, 5%, 680 OHM	1
10				
11				
12				
13	C1	161992	CAPACITOR, 0.1 uF	1
14				
15				
16	CR1,3-13	309617	DIODE, LIGHT EMIT	12
17				
18				
19	Q1	203364	TRANSISTOR	1
20				
21	U1	408351	I.C., #MM74C154N	1
22	U2, U3	288605	I.C., #SN7416N	2
23	U4	355180	I.C., #4025	1
24				
25		152207	TRANSISTOR MTG. SPACER	1
26		427641	SOCKET MODIFIED	12
27	P44 P45	380683	CONTACT PIN, MOLEX	2
28		412106	SWITCH ACTUATOR	30
29		401299	SWITCH COVER	30
30		414516	SWITCH CONTACT	30
31		416875	SWITCH CONTACT SPRING	30
32		406819	PUSHBUTTON, LIGHT PUTTY GREY	17
33		406876	PUSHBUTTON, LIGHT BLUE	1
34		406884	PUSHBUTTON, WHITE	11
35		420620	PUSHBUTTON, ORANGE	1
36		380352	SWAGED SPACER	7

12 INSTALL ITEM 36 CKT 1 SIDE 7 PLACES AFTER FLOW SOLDER AND LEAD TRIM.

11 TRIM LEADS ON ITEM 16 TO .289/.300 BEFORE INSTALLING.

10. ASSEMBLE PLASTIC PARTS OF SWITCHES AFTER FLOW SOLDER OPERATION AS SHOWN IN DETAIL A.
9. MASK ITEM (27), P44 & P45, MTG. HOLES AND MOUNTING SPACERS (7 PLACES) ON CKT 1 PRIOR TO FLOW SOLDER.
8. INSTALL (31) SWITCH CONTACT IN HOLES OF SQUARE PADS. THEN INSTALL (30) SPRING CONTACT INTO HOLES SHOWN.

7 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177, OR EQUIVALENT.)

6. CLEAN ASSEMBLY PER S.O.P. 89.4.
5. TRIM LEADS TO .050 MAX. LONG

4 HAND SOLDER ITEM (27), P44 & P45, AFTER FLOW SOLDER AND LEAD TRIM.

3. ASSY. PER S.O.P. 111.8.
2. FOR REFERENCE DESIGNATION DRAWING SEE 2240A-1611
1. FOR SCHEMATIC DIAGRAM SEE 2240A-1011

NOTES

REV	CHANGE DESCRIPTION	DR	CHK	APPD
	RELEASED TO PRE-PROD			
C	ADDED NOTE 12 ADDED ITEM 26, 36			
B	DELETED S14, ADDED S33 REVISED DWG BY ADDING LATEST SCREEN			
A	ADDED DETAIL B			
	RELEASED TO PILOT RUN			

PROPRIETARY NOTICE

JOHN FLUKE MFG CO., INC
P O BOX 7428 SEATTLE WA

89536

DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

TOLERANCES

XX ± .020	000 - 100 DIA	± .002 .002
XXX ± .010	101 - 200 DIA	± .004 .002
ANGLES ±	201 - 500 DIA	± .006 .003
	501 - 1.00 DIA	± .010 .006

DR M. SHAVER 6/7/78
CHK T. ADLEY 7-11-78
ENG J. K. [illegible] 7-11-78
ENG Richard Penny 7-11-78
MATERIAL SEE B/M
FINISH SEE NOTES

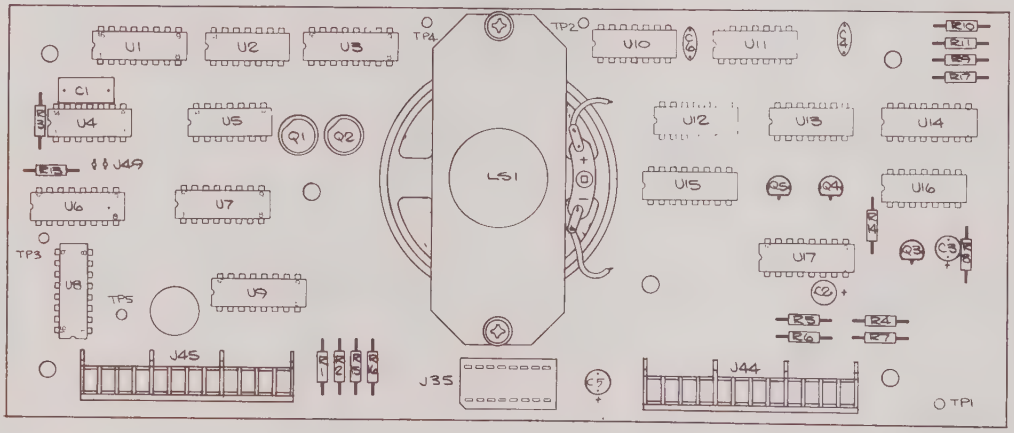
KEYBOARD SWITCH ASSEMBLY

PART NO	SIZE	DRAWING NO
406363	D	2240A-4011

SCALE 2/1 SHT 1 OF 1 REV C

NOTES:
UNLESS OTHERWISE SPECIFIED

1. FOR ASSEMBLY SEE 2240A-4012.
2. FOR SCHEMATIC DIAGRAM SEE 2240A-1012.



RELEASED TO PRE-PROD 5-3-79 KB
RELEASED TO PILOT RUN 7/11/79 KB

FLUKE	JOHN FLUKE MFG CO INC P O BOX 7428 SEATTLE WA	DR	H. SHIVER 6-8-79
89536	DO NOT SCALE DRAWING DIMENSIONS IN INCHES	CHK	MOREY 7-11-79
	TOLERANCES	ENG	JCP 7-11-79
		ENG	Robert D. Brown 7-11-79
		MATERIAL	
		FINISH	

REF. DES. DWG., KEYBOARD LOGIC

PART NO —
SIZE D
DRAWING NO 2240A-1612
SCALE 2/1
SHT — OF — REV —

ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409102	KEYBOARD LOGIC PCB	1
2				
3		415224	SPEAKER BRACKET	1
4	R6	193391	RESISTOR 1/4W, 5% 39Ω	1
5	R5	261842	RESISTOR 1/4W, 5% 62Ω	1
6	10	148007	RESISTOR 1/4W, 5% 680Ω	4
7	R8	221606	RESISTOR 1/4W, 5% 16K	1
8	R7	148163	RESISTOR 1/4W, 5%, 47K	1
9	R10	148189	RESISTOR 1/4W, 5%, 100K	1
10	R9	182212	RESISTOR 1/4W, 5%, 150K	1
11	R11	248781	RESISTOR 1/4W, 5%, 200K	1
12	R3	182204	RESISTOR 1/4W, 5%, 1MEG	1
13	11	160796	RESISTOR 1/4W, 5%, 8.2K	4
14				
15	C4	357806	CAPACITOR, 1000PF,	1
16	C1	271577	CAPACITOR .022UF	1
17	C3	364216	CAPACITOR 2.2UF	1
18	C6	105593	CAPACITOR 100PF	1
19	C2 & C5	176214	CAPACITOR 10UF	2
20				
21				
22				
23	Q5	381798	TRANSISTOR, TO-92	1
24	Q3, Q4	218396	TRANSISTOR, 2N3904	2
25	Q1, Q2	203364	TRANSISTOR	2
26				
27	U6, U7	407759	I.C. MM80C97N	2

ITEM	REF DES	P/N	NOMENCLATURE	QTY
28	U10	355172	I.C. #CD4001AE	1
29	U11	408013	I.C. #CD4007AE	1
30	8	340117	I.C. #MC 14013L	3
31	U13	375147	I.C. #CD4023	1
32	U1, U14	381848	I.C. #CD4049AE	2
33	U2	408393	I.C. #CD4071 E	1
34	U4	408401	I.C. #CD4081 E	1
35	U3	408369	I.C. MC14556CP	1
36	9	408377	I.C. SN74LS75N	3
37	U17	404186	I.C. SN74LS123N	1
38				
39	J35	276535	I.C. SOCKET	1
40	LS1	339879	MINIATURE SPEAKER	1
41	J44, J45	380691	PCB CONNECTOR	2
42	J49	379438	POST CONNECTOR	2
43		152207	TRANSISTOR, MTG. SPACER	2
44		200725	#26 TEFLON WIRE (YELLOW)	.17'
45				
46		152124	SCREW 4-40 X 3/8 LG.	2
47		110403	WASHER #4	2

11 R13, R15, R16, R17

10 R1, R2, R4 & R14

9 U8, U9 & U15

8 U5, U12 & U16

7 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED, USING INKSTAMP (PERMA-DRI 177, OR EQUIVALENT).

6. CLEAN ASSEMBLY PER S.O.P. 89.4.

5. TRIM LEADS TO .050 MAX. LONG

4 HAND SOLDER ITEM 44 AS INDICATED TO SPEAKER.

3. ASSY PER S.O.P. 111.8.

2. FOR REFERENCE DESIGNATION DRAWING SEE 2240A-1612.

1. FOR SCHEMATIC DIAGRAM SEE 2240A-1011.

NOTES.

SEE SHEET 2 FOR ASSEMBLY DWG.

REV	CHANGE DESCRIPTION	DR	CHK	APPR
	RELEASED TO PRE-PROD	SM		
A	NOTE 5 WAS: PER SOP 89.19 CHANGED ITEM 39 WAS: 291534.	SM		
	RELEASED TO PILOT RUN	SM		

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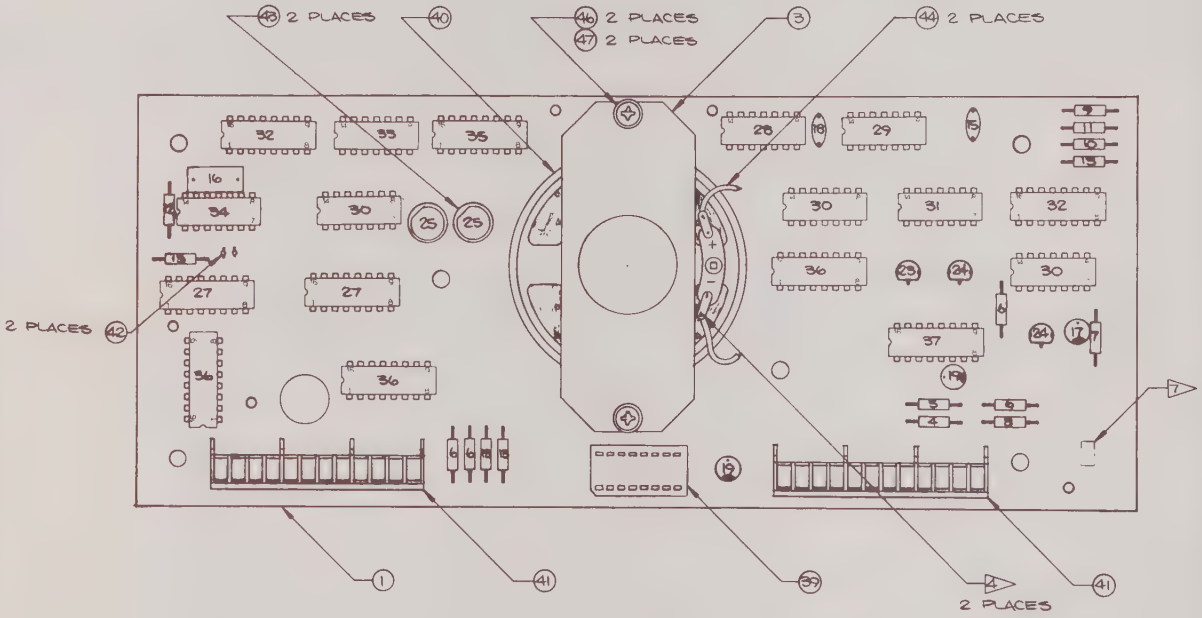
FLUKE | JOHN FLUKE MFG CO INC, P.O. BOX 7428 SEATTLE WA | 89536 | DO NOT SCALE DRAWING, DIMENSIONS IN INCHES

TOLERANCES: XX ± .020, XXX ± .010, ANGLES ± 1°

DR	M. SHAVER	6-8-5
CHK	T. MOREY	7-11-5
ENG		7-11-5
ENG		7-12-5
MATERIAL		
FINISH		

KEYBOARD LOGIC ASSEMBLY

PART NO.	SIZE	DRAWING NO.
406371	D	2240A-4012
SCALE 2/1	SHT 1 OF 2	REV A



SEE SHEET 1 FOR PARTS LIST

— SEE SH 1 FOR REV —

REV	CHANGE DESCRIPTION	DR	CHK	APPR

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FLUKE	JOHN FLUKE MFG CO INC	DR U SHAVER	7-11-75
	P O BOX 7428 SEATTLE WA	CHK [illegible]	7-11-75
89536	DO NOT SCALE DRAWING DIMENSIONS IN INCHES	ENG [illegible]	7-11-75
		ENG Robert Duncan	7-11-75

TOLERANCES

XX ± .020	000 100 DIA	± .003 .002
XXX ± .010	101 .200 DIA	± .006 .002
ANGLES ±	201 .500 DIA	± .006 .003
	501 1.00 DIA	± .010 .005

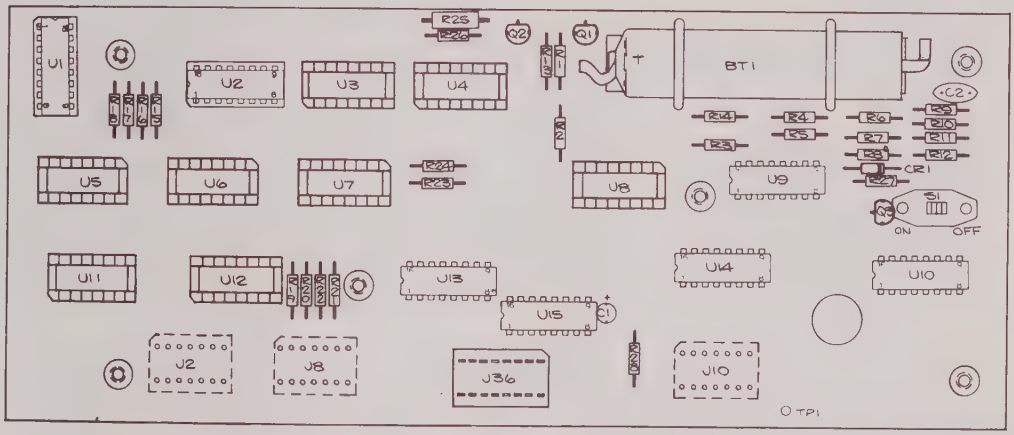
MATERIAL SEE BOM SH 1

FINISH SEE NOTES SH 1

KEYBOARD LOGIC ASSEMBLY

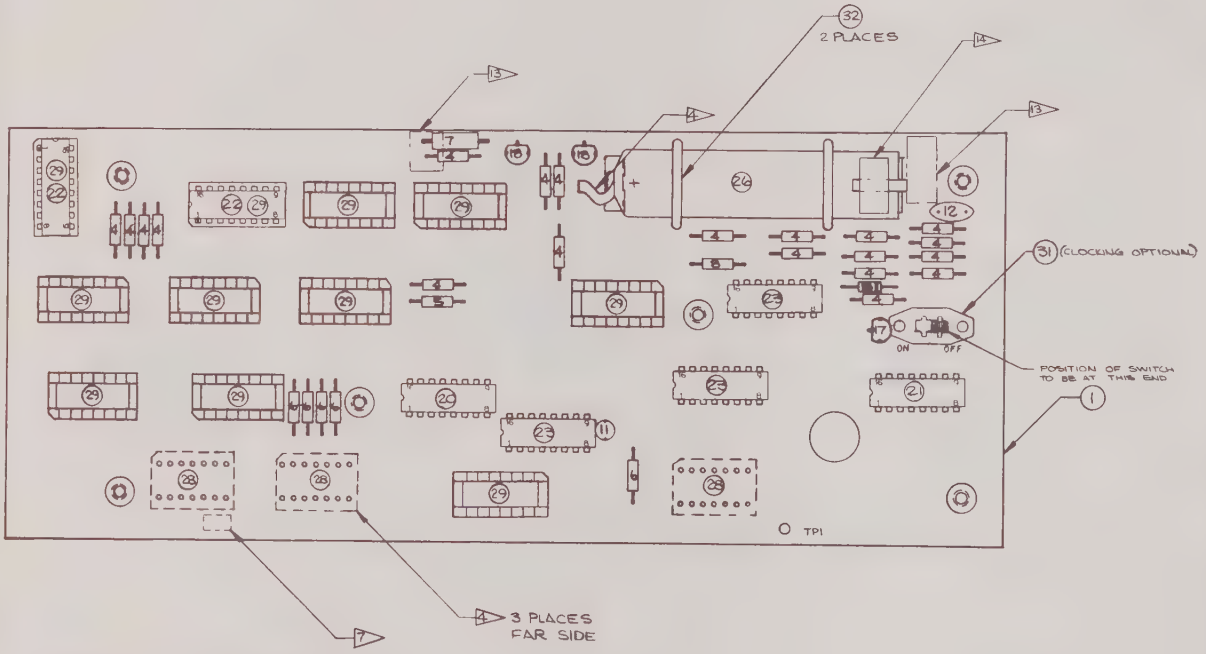
PART NO	SIZE	DRAWING NO.
406371	D	2240A-4012
SCALE 2/1	SHT 2 OF 2	REV 4

NOTES:
UNLESS OTHERWISE SPECIFIED
1. FOR ASSEMBLY SEE 2240A-4013.
2. FOR SCHEMATIC DIAGRAM SEE 2240A-1013.



When ordering replacement parts for U3 thru U8, U11 or U12 specify part number 408385.

RELEASED TO PRE PROD
RELEASE TO PILOT RUN
JOHN FLUKE MFG CO INC
P.O. BOX 7428 SEATTLE WA
89536
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES
DR U. SHAVER 6/20/75
CHK F. EDELMAN 7-11-75
ENG SMH JKP 7/11/75
KEYBOARD MEMORY REFERANCE DESIGNATION DRAWING
PART NO
SIZE D
DRAWING NO 2240A-1613
SCALE 2/1
SHT 1 OF 1
REV



ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409110	KEYBOARD MEMORY PCB	1
2				
3				
4	5	148098	RESISTOR 1/4W, 5% 6.8K	20
5	R23	193417	RESISTOR 1/4W, 5% 30K	1
6	5	148163	RESISTOR 1/4W, 5% 47K	5
7	R25	108597	RESISTOR 1/2W, 5% 1K	1
8	R3	148114	RESISTOR 1/4W, 5%, 15K	1
9				
10				
11	C1	193623	CAPACITOR 10UF	1
12	C2	149161	CAPACITOR .05UF	1
13				
14				
15	CR1	203323	DIODE IN4148	1
16				
17	Q3	370072	TRANSISTOR	1
18	Q1, Q2	218081	TRANSISTOR	2
19				
20	U13	381848	IC #CD4049AE	1
21	U10	407981	IC MM74C42N	1
22	U1, U2	408385	IC	2
23	10	407759	IC MM80C97N	3
24				
25				
26	BT1	408286	LITHIUM BATTERY	1
27				
28	11	276527	IC SOCKET	3
29	J36	276535	IC SOCKET	11
30				
31	S1	386813	SLIDE SWITCH	1
32		104794	STRAP, RUBBER	2

13 MASK AREA SHOWN FAR SIDE USING 954735 MYLAR TAPE AFTER FLOW SOLDER AND LEAD TRIM.

14 BEND BACK POSITIVE LEAD OF ITEM 33 APPROX. AS SHOWN. TAPE IN POSITION USING 954735 MYLAR TAPE.

11 J2, J8, J10.

10 J9, U14, U15.

5 R1, R2, R4-R18, R24, R26 & R27.

8 R19, R20, R21, R22, R28.

7 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177, OR EQUIVALENT).

6. CLEAN ASSEMBLY PER S.O.P. 89.4.

5. TRIM LEADS TO .100 MAX. LONG PER S.O.P. 89.19.

4 HAND SOLDER ITEM (26) & (28) AS INDICATED (NEAR SIDE)

3. ASSY PER S.O.P. 131.8.

2. FOR REFERENCE DESIGNATION DRAWING SEE 2240A-1613.

1. FOR SCHEMATIC DIAGRAM SEE 2240A-1013.

NOTES:

REV	CHANGE DESCRIPTION	DR	CHK	APPR
–	RELEASED TO PRE-PROD	DA 7/11/75		
A	ADDED NOTE 13 & 14. ITEM 29 QTY WAS: 10 DELETED ITEM 30 UNDER ITEM 28 WAS. 387316	DM 10/15		
–	RELEASE TO PILOT RUN	MB 7/11/75	RK 7/11/75	RL 7/11/75

PROPRIETARY NOTICE

FLUKE | JOHN FLUKE MFG. CO., INC. P.O. BOX 7428 SEATTLE WA | 89536 | DO NOT SCALE DRAWING DIMENSIONS IN INCHES | TOLERANCES

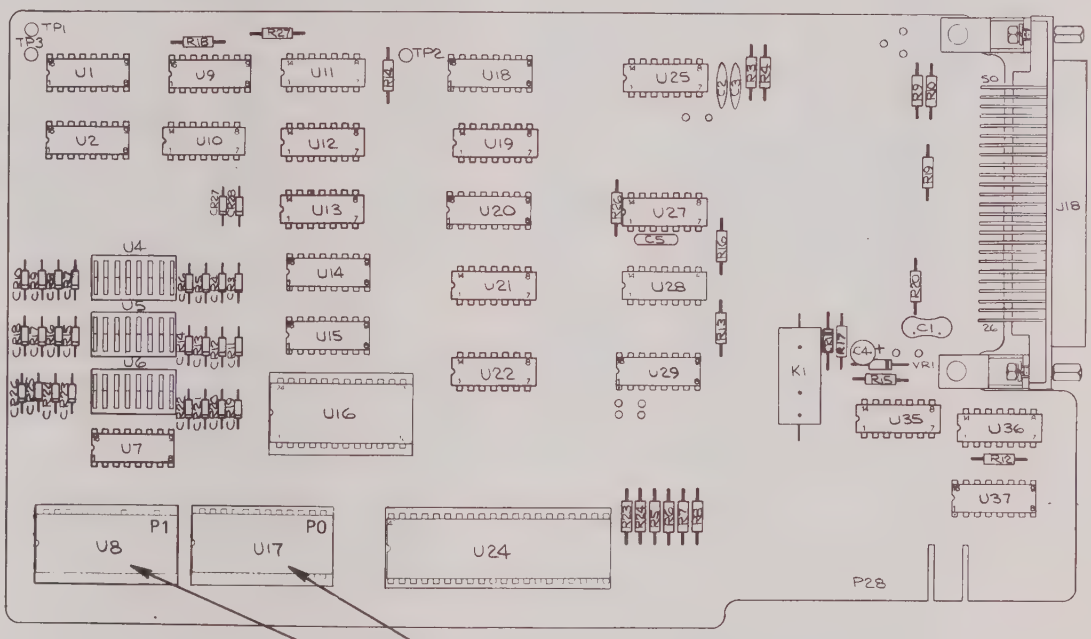
XX ± .030	000 - 100 DIA	± .003 - .003	
XXX ± .010	101 - 300 DIA	± .004 - .002	
ANGLES ±	70 - 500 DIA	± .005 - .003	
	501 - 1.00 DIA	± .010 - .006	

DR	M. SHAVER	6/2/75
CHK	F. EDELMAN	7-11-75
ENG	SHB	7/11/75
ENG	Robert Morris	7/11/75
MATERIAL		
FINISH		

KEYBOARD MEMORY ASSEMBLY

PART NO.	SIZE	DRAWING NO.
406389	D	2240A-4013

SCALE 2/1 | SHT 1 OF 1 | REV A



When ordering replacement IC's (U8 or U17), describe the option using option number and letter suffix. If part is for a −14 series option, also specify recorder code and number of tracks. In addition to description, specify part number 432757 and reference designation U8 or U17.

NOTES:
1. FOR ASSEMBLY DWG SEE 2200A-4014.
2. FOR SCHEMATIC DIAGRAM SEE 2200A-1014.

RELEASED TO PILOT RUN

FLUKE	JOHN FLUKE MFG. CO. INC	TELETYPE REFERENCE DESIGNATION DRAWING
89536		D 2200A-614

ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409255	PCB, OUTPUT OPTIONS	1
2				
3	R15	193482	RES 1/4W, 5%, 200Ω	1
4	R23	148056	RES 1/4W, 5%, 3.3K	1
5	[9]	148106	RES, 1/4W, 5%, 10K	4
6	[A]	148023	RES, 1/4W, 5%, 1K	12
7	R3, 4, 26	221598	RES, 1/4W, 5%, 13K	3
8				
9				
10				
11	C4	330662	CAP, 25VDCW, 10UF	1
12	C3 & 7	105734	CAP, 500VDCW, 10%, 300PF	2
13	C1	385328	CAP, 400 PF, 1%	1
14	C5	179077	CAP, 25V, 0.68UF	1
15	VR1	340695	ZENER DIODE, 10V, 5%, 1W	1
16	[8]	203323	DIODE SW, IN4148	27
17				
18				
19	U2	376962	RES NET 1/4W, 5%, 22K	1
20	U35	414037	IC SN74LS33	1
21	U14,20,29	355214	IC #4009	3
22	U18	355412	IC #4010	1
23	U10 & 28	355198	IC #4011	2
24	U12	355172	IC #4001	1
25	U19	375147	IC 4023	1
26	U21	355206	IC #4012	1
27	U13	363820	IC #4002	1
28	U11,22,25	340117	IC MC 14013L	3
29	U9	355230	IC #4027	1
30	U36	414052	IC LM1488	1
31	U27	414045	IC LM1489	1
32	U37	412742	IC 74C173	1
33	U7	407981	IC #MM74C 42N	1
34	U16	404418	IC 4040	1
35	U24	404434	IC 4089	1
36	U15	404442	IC 4002-1	1
37				
38	U1	407759	IC MM80C97N	1
39				
40				
41				
42	K1	357509	RELAY, REED 4.5V #UF-40066	1
43				
44				
45				
46				
47	U4, 5, 6	414490	SWITCH MODULE	3
48	J18	414417	CONNECTOR	1
49		417394	CONNECTOR HDW. KIT	1
50		418970	SOCKET 24 PIN	3
51		418988	SOCKET 40 PIN	1
52		152124	SCREW 4-40 X 3/8	4
53		110395	WASHER, LOCK #4	4
54		147611	NUT, 4-40	4
55		376418	SOCKET	11

[9] R24, 20, 13, 27

[8] CR1, 3 THRU 28

[A] R5, 6, 7, 8, 9, 10, 12, 14, 16—19.

[6] PARTS INDICATED ARE SUPPLIED IN (49) HARDWARE KIT.

[5] MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177 OR EQUIVALENT).

4. CLEAN ASSEMBLY PER S.O.P. 89.4.
3. TRIM LEADS TO .100 MAX. LONG.
2. ASSEMBLE PER S.O.P. 111.8.
1. FOR SCHEMATIC DIAGRAM SEE 2200A-1014. FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1614.

SEE SHEET 2 FOR ASSEMBLY DWG.

RELEASED TO PILOT RUN

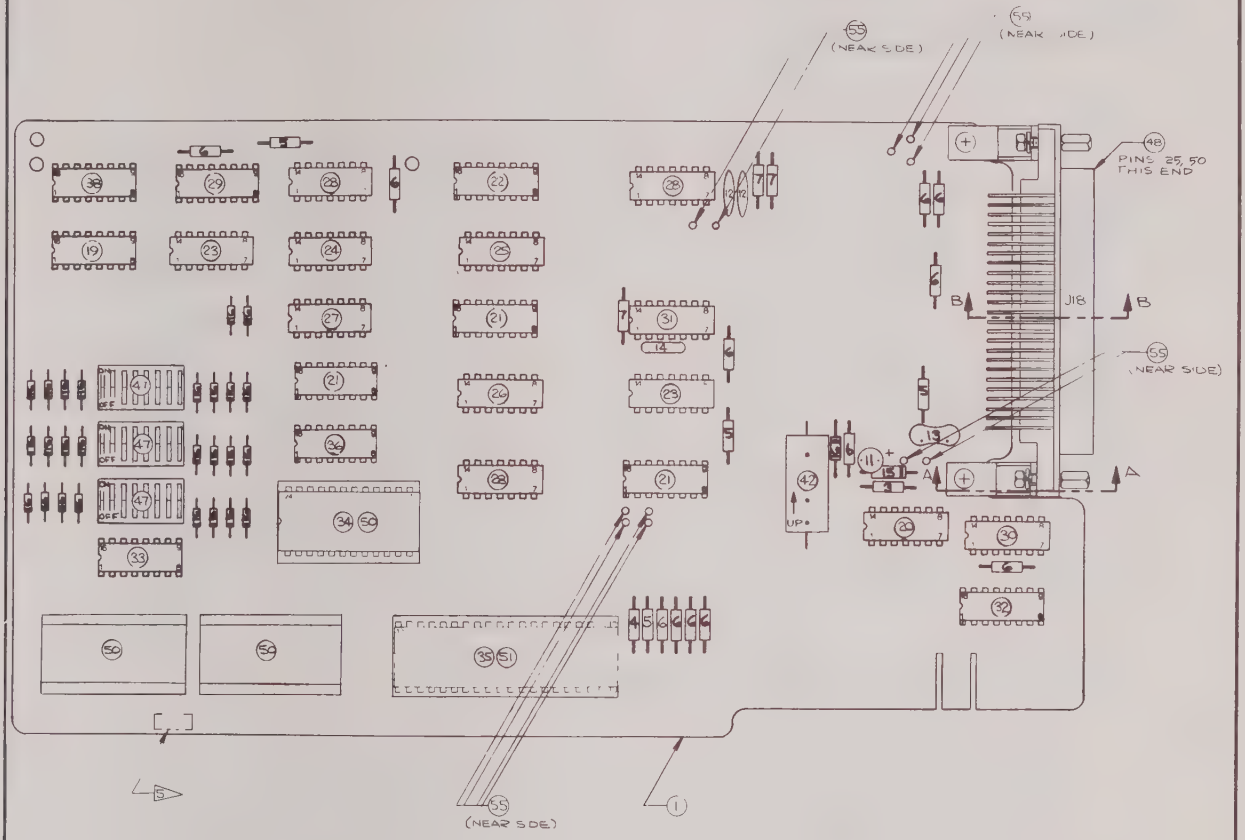
PROPRIETARY NOTICE

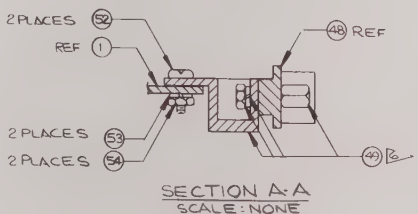
FLUKE JOHN FLUKE MFG CO INC
P O BOX 7428 SEATTLE WA
89536
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES
TOLERANCES

DR MOREY 12 6 85
CHK 11-11-85
ENG L.K. Pickel 5-28-86
ENC
MATERIAL
FINISH

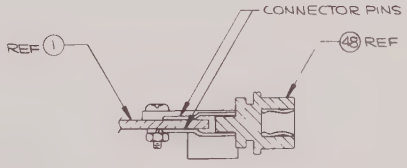
TELETYPE ASSEMBLY

PART NO 409359 | SIZE D | DRAWING NO 2200A-4014
SCALE | SHT 1 OF 2 | REV





SECTION A-A
SCALE: NONE

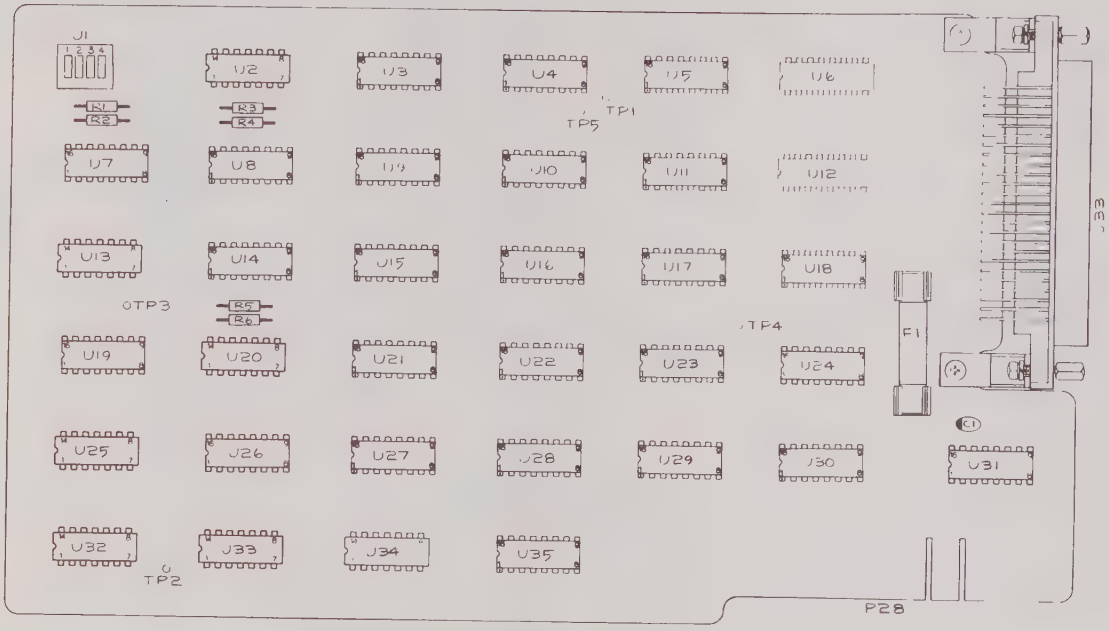


SECTION B-B
SCALE: NONE

FLUKE	JOHN FLUKE MFG CO INC P O BOX 7428 SEATTLE WA	DR T MOREY	REV				
89536	DO NOT SCALE DRAWING DIMENSIONS IN INCHES	CHK					
	TOLERANCES	ENG					
		MATERIAL		TELETYPE ASSEMBLY			
		FINISH		PART NO	SIZE	DRAWING NO	
				409359	D	2200A-4014	
				SCALE 2X1	SHT 2 OF 2	REV —	

NOTES:

1. FOR ASSEMBLY DWG. SEE 2200A-4017.
   FOR SCHEMATIC DIAGRAM SEE 2200A-1017.



REV	CHANGE DESCRIPTION	DR	CHK	APPR
	RELEASED TO PRE-PROD			
A	ADDED E1			
	RELEASED TO PILOT			

PRELIMINARY NOTICE

FLUKE | JOHN FLUKE MFG CO INC
P.O. BOX 7428 SEATTLE WA
89536
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

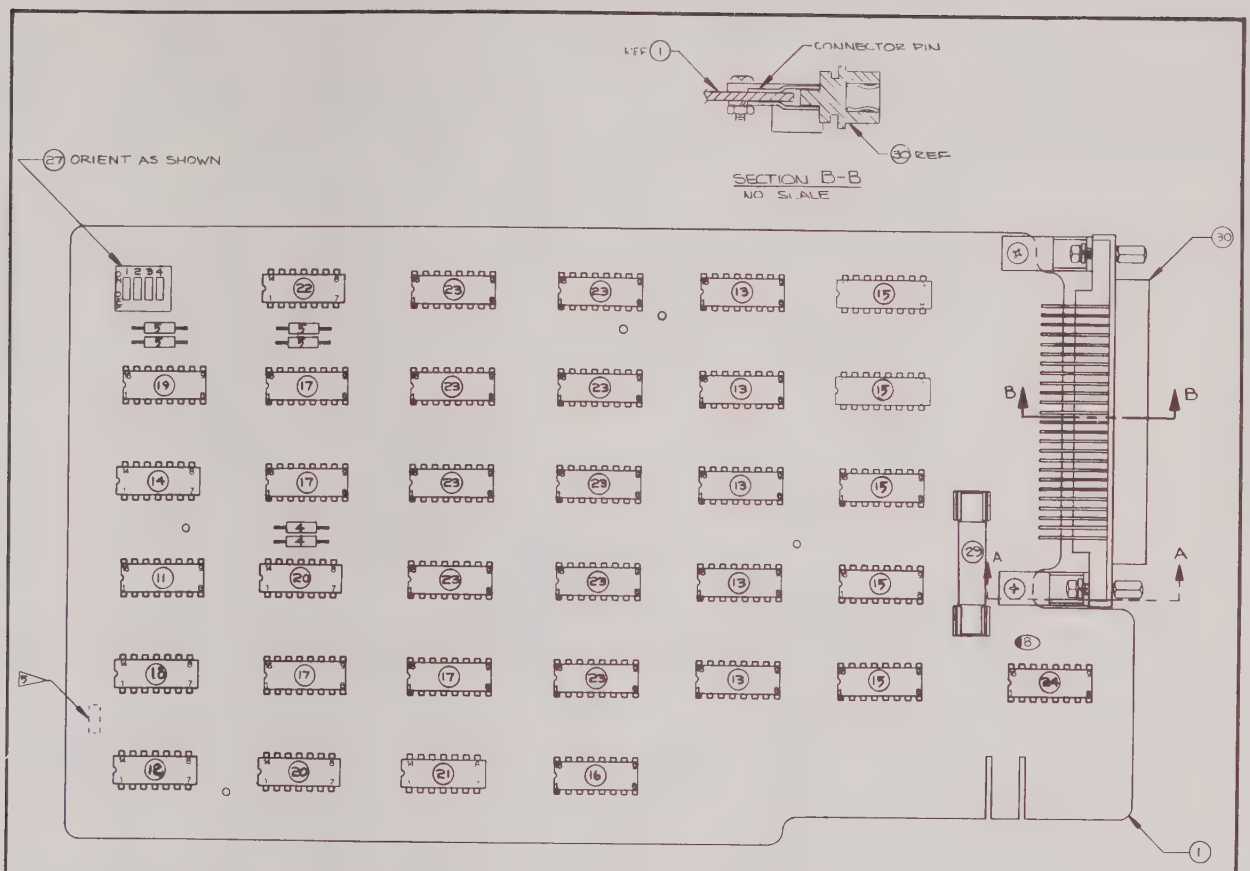
DR G. SCHILLING 4/9/75
CHK T. MOREY 4/18/75
ENG SP 4/11/75
ENG
MATERIAL —
FINISH —

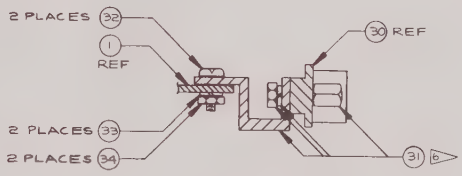
TOLERANCES

.X ± .020	000 - 100 DIA	.003 .002
.XX ± .010	101 - 200 DIA	.004 .002
ANGLES ± ½°	201 - 500 DIA	.006 .003
	.501 - 1.00 DIA	.010 .005

REF. DES. DWG.
DIGITAL INPUT

PART NO	SIZE	DRAWING NO
—	D	2200A-1617
SCALE —	SHT 1 OF 1	REV A





ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409268	PCB, DIGITAL INPUT	1
2				
3				
4	R5, 6	147926	RES, COMP. 1/4W, 5% 100 Ω	2
5	R1-4	148106	RES, COMP 1/4W, 5% 10K	4
6				
7				
8	C1	330662	CAP. TANTALUM, 10UF	1
9				
10				
11	U19	355230	I.C. #4027	1
12	U32	340117	I.C. MC 14013L	1
13	7	380618	RES. NETWORK 100K	5
14	U13	375147	I.C. CD 4023AE	1
15	8	381996	RES. NETWORK 47K	5
16	U35	355412	I.C. #4010	1
17	9	355214	I.C. #4009	4
18	U25	355138	I.C. #4011	1
19	U7	403560	I.C. #CD4017AE	1
20	U20,33	355172	I.C. #4001	2
21	U34	355206	I.C. #4012	1
22	U6	355222	I.C. #4030	1
23	9	412742	I.C. 74C173	9
24	U31	407759	I.C MM80C97N	1
25				
26				
27	U1	408559	SWITCH MODULE	1
28				
29	F1	109314	FUSE, 1/4 AMP	1
30	J33	414417	CONNECTOR 64 POS.	1
31		417394	CONNECTOR HDW. KIT	1
32		252124	SCREW 4-40 X 3/8	2
33		110395	WASHER, LOCK, #4	2
34		147611	NUT, 4-40	2

5 U3, 4, 9, 10, 15, 16, 21, 22, 28.

8 U8, 14, 26, 27.

8 U6, 12, 18, 24, 30.

7 U5, 11, 17, 23, 29.

6 PARTS INDICATED ARE SUPPLIED IN (31) HARDWARE KIT.

5 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177 OR EQUIVALENT).

4. CLEAN ASSEMBLY PER S.O.P. 89.4.

3. TRIM LEADS TO .100 MAX. LONG PER S.O.P. 89.19.

2. ASSEMBLE PER S.O.P. 111.8.

1. FOR SCHEMATIC DIAGRAM SEE 2200A-1317 FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1617.

NOTES

REV	CHANGE DESCRIPTION	DR	CHK
A	RELEASED TO PRE-PROD DELETED (U20, 25, 33) ITEM 4 P/N WAS 148 183 ITEM 8 WAS ITEM 20 ADDED ITEM 29 & SECT B-B		
	RELEASED TO PILOT		

PROPRIETARY NOTICE

FLUKE | JOHN FLUKE MFG CO., INC. P.O. BOX 7428 SEATTLE WA | 89536 | DO NOT SCALE DRAWING DIMENSIONS IN INCHES

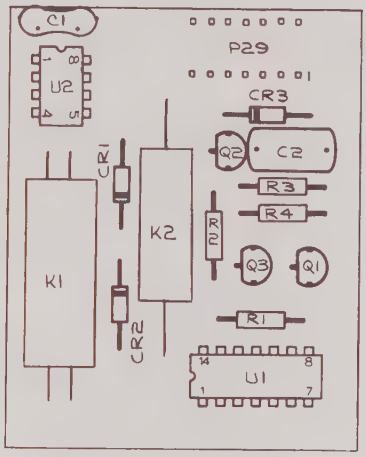
TOLERANCES

DR G. SCHILLING 9/1/95
CHK T. MOREY 7-9-5
ENG 9-12-5
ENG
MATERIAL SEE B/M
FINISH SEE NOTES

DIGITAL INPUT ASSEMBLY

PART NO.	SIZE	DRAWING NO.
406397	D	2200A-4017

SCALE 2/1 SHT 1 OF 1 REV A



NOTES:

1. FOR ASSEMBLY DRAWING SEE 2200A-4021
2. FOR SCHEMATIC DIAGRAM SEE 2200A-1021

REV	CHANGE DESCRIPTION	DR	CHK	APPR
	RELEASED TO PRE PROD	G.S. 10/7/75	ABL 10-16-75	
A	ADDED CR3, C2; REV R1-R4, Q1-Q3 POSN	G.S. 10/7/75	ABL 10-14-75	
—	RELEASED TO PILOT	EM 7/29/75	JEC 8/4/75	RB 8-5-75

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FLUKE — JOHN FLUKE MFG. CO., INC.
P.O. BOX 7428, SEATTLE WA.

89536

DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

TOLERANCES

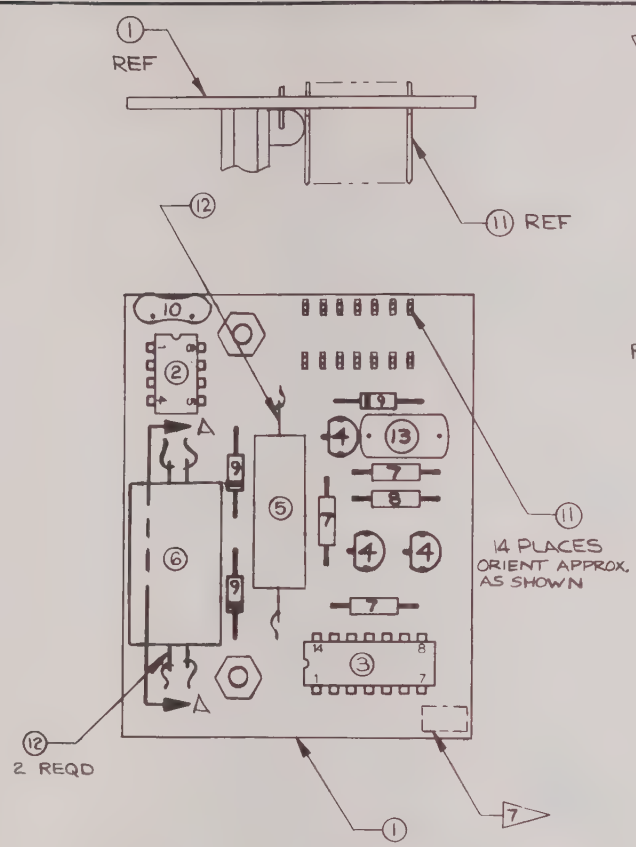
XX ± 020	000 100 DIA	·003 002
XXX ± 010	101 200 DIA	·004 002
ANGLES °	201 500 DIA	·006 003
X_C ·	501 1.00 DIA	·010 005

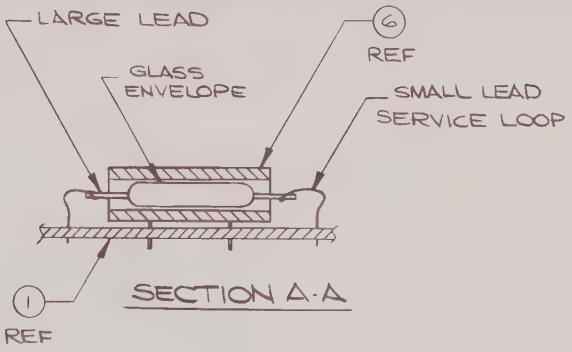
DR	M. BROWN	7-15-75
CHK	T MOREY	7-23-75
ENG	[illegible]	7/29/75
ENG	Robert Fleming	8/4/75
MATERIAL		
FINISH		

TEMPERATURE OPTION - REFERENCE DESIGNATION DWG

PART NO.	SIZE	DRAWING NO.
	C	2200A-1621

SCALE 2/1 — SHT 1 OF 1 — REV A





ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409284	PCB, TEMPERATURE OPTION	1
2	U2	363515	I.C. AN301AN	1
3	U1	393033	I.C. 74LS00	1
4	Q1, 2, 3	195974	TRANSISTOR 2N3906	3
5	K2	269019	COIL U-6-P	1
6	K1	272070	COIL, REED RELAY UD-6-P	1
7	R1, 2 & 3	148072	RESISTOR 1/4W, 5%, 4.7K	3
8	R4	148049	RESISTOR 1/4W, 5%, 2.2K	1
9	CR1, 2, 3	203323	DIODE IN4148	3
10	C1	160317	CAPACITOR 33PF	1
11	P29	267633	CONNECTOR .025SQ	14
12		414300	REED SW	3
13	C2	271577	CAP, .047	1

8. TO PREVENT FIELD FAILURES WHICH ARE NOT DETECTABLE IN TEST, HANDLE (12) AS FOLLOWS. DO NOT BEND LARGE LEADS WHICH ENTER THE GLASS ENVELOPE. REED SWITCH UNUSABLE IF LARGE LEADS ARE BENT. MAKE SERVICE LOOP IN SMALL LEAD WHICH ATTACHES TO PCB PRIOR TO SOLDERING. (SEE SECTION A-A)

7 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177 OR EQUIVALENT).

6. SPECIAL CLEANING REQUIREMENTS
FINAL WASH ASSY TO REMOVE SALTS PER 6.2.5 OF S.O.P. 89.16. AFTER WASH HANDLE ASSY SUCH THAT CIRCUITRY NOT BE HANDLED WITH BARE HANDS. PACKAGE ASSY IN PLASTIC BAGS OR EQUIVALENT TO PREVENT LATER CONTAMINATION.

5. TRIM LEADS TO .050 MAX. LONG

3. ASSEMBLE PER S.O.P. 111.8.
2. FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1621.
1. FOR SCHEMATIC DIAGRAM SEE 2200A-1021.

NOTES:

REV	CHANGE DESCRIPTION	DR	CHK	APPR
	RELEASED TO PRE-PROD	BSM 6-13-75	ADL 10-1-75	R.B. 10/15
A	ADDED ITEM 13, DEL NOTE 4 COMPLETELY REV NOTE 6&8	BSM 7-8-75	ADL 10-1-75	
—	RELEASED TO PILOT	BSM 7-7-75	RC 7-8-75	RP 7-8-75

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FLUKE 89536
JOHN FLUKE MFG. CO., INC.
P.O. BOX 7428, SEATTLE WA
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES
TOLERANCES
XX ± .020
XXX ± .010
ANGLES ±
X_C -

000- 100 DIA	± .003	.002
101- 200 DIA	± .004	.002
201- 500 DIA	± .006	.003
501 1.00 DIA	± .010	.005

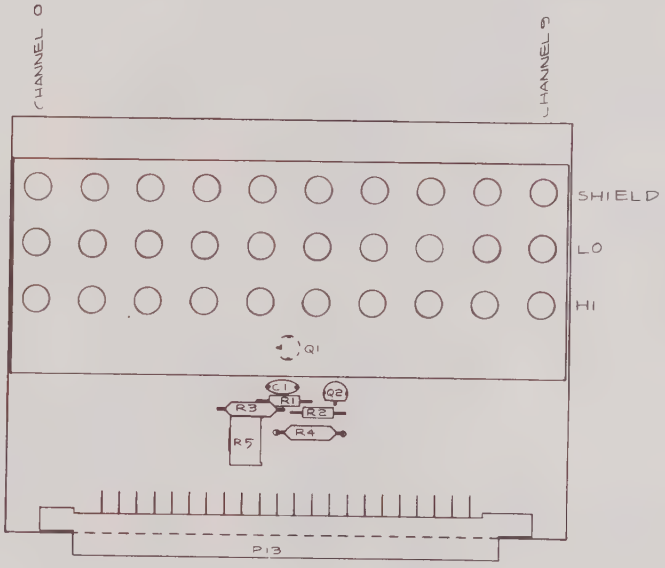
DR M. BROWN 7-15-75
CHK T. MOREY 7-23-75
ENG J. Ste... 7-31-75
ENG Robert Thomas 8/5/75
MATERIAL
FINISH

TEMPERATURE OPTION PCB ASSEMBLY

PART NO.	SIZE	DRAWING NO.
409383	C	2200A-4021

SCALE 2/1 SHT 1 OF 1 REV A

NOTES:
UNLESS OTHERWISE SPECIFIED
1. FOR ASSEMBLY SEE 2200A-4023.
2. FOR SCHEMATIC DIAGRAM SEE 2200A-1023.



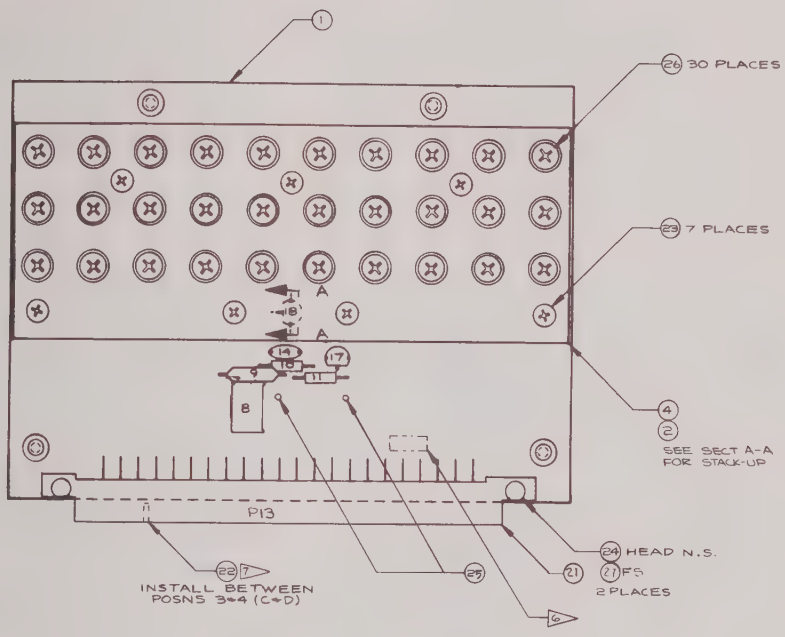
RELEASED TO PRE-PROD
RELEASED TO PLOT

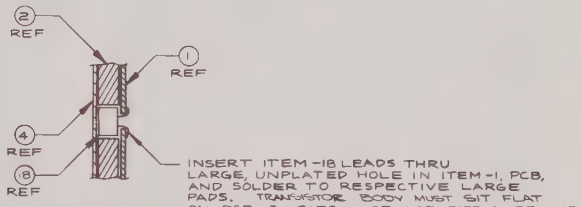
FLUKE
JOHN FLUKE MFG CO INC
89536

DRG G SCHILLING 7/21/75
CHK T MOREY 7/22/75

REF. DES. DWG., ISOTHERMAL INPUT

D 2200A-1623




2 REF
1 REF
4 REF
18 REF
INSERT ITEM -18 LEADS THRU LARGE, UNPLATED HOLE IN ITEM -1, PCB, AND SOLDER TO RESPECTIVE LARGE PADS. TRANSISTOR BODY MUST SIT FLAT ON PCB & LEADS MUST NOT EXTEND BEYOND PADS AFTER SOLDERING.

SECTION A-A

ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409300	PCB, ISOTHERMAL	1
2		412379	ISOTHERMAL BLOCK	1
3				
4		373340	INSULATOR	1
5				
6				
7				
8	R5	414102	RESISTOR, VARIABLE 150K	1
9	R3	221648	RES, MF 1/8W 1%, 130K	1
10	R1	192948	RES, COMP 1/4W, 5%, 330K	1
11	R2	148072	RES, COMP 1/4W, 5%, 4.7K	1
12				
13				
14	C1	149161	CAP, CCRAM,50VDCW .05UF	1
15				
16				
17	Q2	357905	TRANSISTOR, J-FET, #F2690	1
18	Q1	380394	TRANSISTOR	1
19				
20				
21	P13	385674	CONNECTOR	1
22		407254	CONNECTOR POLARIZING INSERT	1
23		152132	SCREW 4-40 X 1/2 PHP	7
24		276493	RIVET, #4 X .500	2
25		343285	SOCKET, COMP. LEAD	2
26		385401	SCREW ST. ST. PHP 6-32 THD 1/4L	30
27		147728	WASHER, FLAT #4	2
28				
29				

7 CEMENT KEY IN PLACE USING CONTACT CEMENT JF NO. 958740 (PERMABOND 102) OR EQUIV.

6 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177 OR EQUIV.).

5. CLEAN ASSEMBLY PER S.O.P. 89.4.
4. TRIM LEADS .100 MAX LONG PER S.O.P. 89.19.
3. ASSEMBLE PER S.O.P. 111.8.
2. FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1623.
1. FOR SCHEMATIC DIAGRAM SEE 2200A-1023.

NOTES:

REV	CHANGE DESCRIPTION	DR	CHK	APPR
A	RELEASED TO PRE PROD ITEM 24 WAS 145813; ITEM 27 WAS 110695, ITEM 28 WAS 110775, QTY 2 ITEM 29 WAS 110395, QTY 2 ITEMS 27, 28 & 29 WERE "F S" ITEM 24 WAS "HEAD N.S." ITEM 28 WAS 381749	GM 7/2/75	RR 8/6/75	RR 8/15/75
—	RELEASED TO PILOT	GM 7/2/75	RR 8/6/75	RR 8/15/75

PROPRIETARY NOTICE

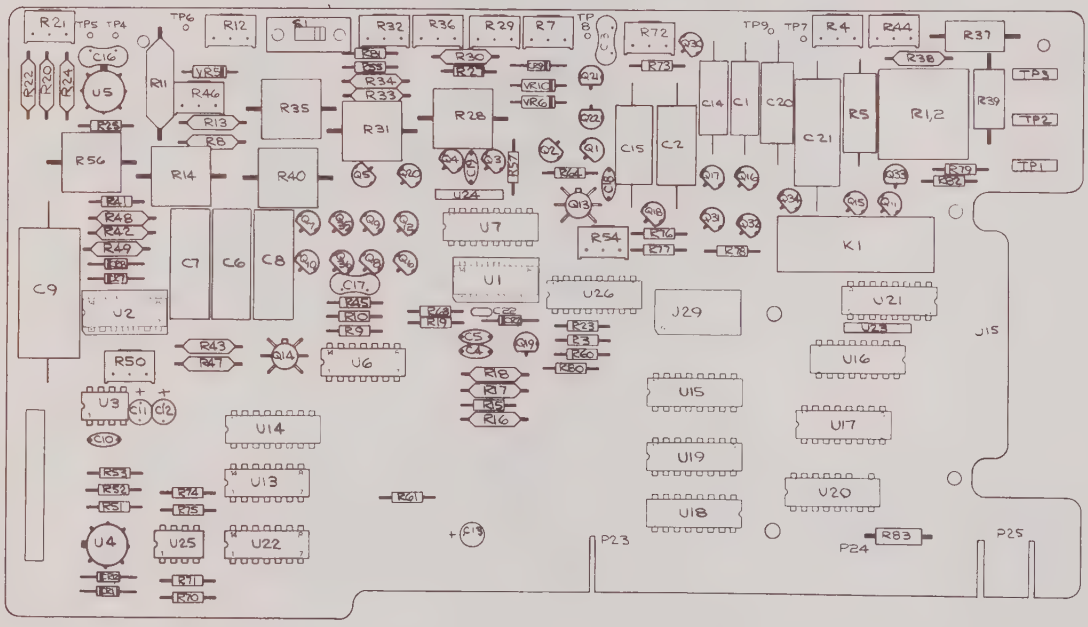
FLUKE | JOHN FLUKE MFG CO INC, P O BOX 7428 SEATTLE WA | 89536 | DO NOT SCALE DRAWING DIMENSIONS IN INCHES | TOLERANCES

DR G SCHILLING 7/2/75
CHK T MOREY 7/23/75
ENG [illegible] 8/6/75
ENG [illegible] 8-5-75
MATERIAL SEE B/M
FINISH SEE NOTES

ISOTHERMAL INPUT ASSY.

PART NO	SIZE	DRAWING NO
406413	D	2200A-4023

SCALE 2/1 SHT 1 OF 1 REV A



1. FOR ASSEMBLY DRAWING SEE 2200A-4028
2. FOR SCHEMATIC DIAGRAM SEE 2200A-1028

RELEASED TO PRE PROD			
RELEASE TO PILOT			
CHANGE DESCRIPTION	DR	CHK	APPR
FLUKE 89536 — JOHN FLUKE MFG CO INC, P O BOX 7428 SEATTLE WA	DR T MOREY 7/6/75		
DO NOT SCALE DRAWING — DIMENSIONS IN INCHES	CHK M SHAVER 8-22-75		
TOLERANCES	ENG 8-27-75		
MATERIAL	ENG		
FINISH			

1 uV A D REFERENCE DESIGNATION DRAWING

PART NO.	SIZE	DRAWING NO.
	D	2200A-1628
SCALE 2X1	SHT 1 OF 1	REV —

ITEM	REF. DES.	P/N	NOMENCLATURE	QTY
1		409177	PCB, A-D	1
2				
3	U1 & 2	404087	IC RC4739 DP	2
4	U3	352195	IC #311	1
5	U4	419044	IC #4195T	1
6	U5	412742	IC 74C173	4
7	U19	418798	IC 4048	1
8	U20	380741	IC CD4028AE	1
9	U21	381830	IC #4050AE	1
10	U14	393165	IC 74LS139	1
11	U13	393157	IC 74LS107	1
12	U22	393033	IC 74LS00	1
13	U7 U26	413237	IC ULN-2003A	2
14	U25	418566	IC LM358N	1
15	C21	424234	CAP, 0.39uF	1
16				
17				
18	U6	412759	IC DM8819	1
19	U5	284760	INT. CKT LM308	1
20	Q13	376087	TRANSISTOR	1
21	Q14	379321	TRANSISTOR , DUAL FET #E7024	1
22	Q1	357905	TRANSISTOR, J-FET #F2690	21
23	Q2	376475	TRANSISTOR, FET	5
24	CR1	203323	DIODE 1N4148	6
25	VR6 & 10	277236	DIODE 1N752A	2
26	R40	377283	ZENER REFERENCE SET	1
27	C9	363085	CAP , 0.47UF, 10% 50V	1
28	C6, 7,8	306522	CAP , 2.2UF, 100V	3
29	C1 & 14	424218	CAP, 500VDCW 5% 0.033uF	2
30	C2 & 15	423210	CAP 50VDCW, 10% .22UF	2
31	Q9	105692	CAP, 500VDCW, 10% 500PF	4
32	C10	106211	CAP, 600VDCW, .0027UF	1
33	C11,12&13	330662	CAPACITOR, 10UF, 20V, 20%	3
34	C16	160317	CAP 500VDCW, 5% 33PF	1
35	C3	175208	CAP, 500VDCW, 10% 2PF	1
36	C17	190397	CAP 4PF	1
37	R14	112037	RES, WW BOBBIN, 1/2W, 40K	1
38	R56	277988	RES, 19.991K , 1/2WB	1
39	R28	112045	RES, WW BOBBIN, 1/2W, 22.5K	1
40	R31	171843	RES, WW BOBBIN, 1/2W, 2K	1
41	R40,35	182220	RES, WW BOBBIN, 1/2W, 250Ω	2
42	R37	178780	RES, BOBBIN, 1/4W, 99.975K	1
43	R39	288654	RES, 1.022KΩ+-.05% 0+-5PPM	1
44	R1, 2	375105	RES 9.022M, 900K, 90K, 10K	1
45	R3	148106	RES 1/4W 10K 5%	1
46	R7,21&46	288290	RES. VAR. 50K+/-10%	3
47	R44&72	291609	RES. VAR. 20K	2
48	R29	288282	RES., VAR. 5K+/-10%	1
49	R36	285155	RES., VAR. 1KΩ+/-10%	1
50	R4,12 & 32	291120	RES., VAR. 500Ω+/-10%	3
51	R50,R54	285148	RES., VAR. 200Ω, 10%	2
52	R8	340174	RES 1/8W, 2K, 0.1%	1
53	R22	268797	RES. 1MEG 1/8W 1%	1
54	R20	221648	RES, 130K 1/8W 1%	1
55	R38 & 47	291443	RES. 1/8W, 1%, 75.0K	2
56	R48	271346	RES. 1/8W, 1%, 56.2K	1
57	R30	217976	RES. 806K 1/8W 1%	1
58	R33, 34	248807	RES. 1/8W 1% 100KΩ	2
59	R17, 18	285296	RES. 1/8W 15KΩ, 1%	2
60	R42, 43	268417	RES, 6.81K 1/8W 1%	2
61	R24	235325	RES, 4.02K 1/8W 1%	1
62	R85	190520	RES., 100 MEG., 1/2W, 10%	1
63	R49	291617	RES. 1/8W, 1%, 14.3K	1
64	R16	188367	RES, 1/8W, 1% 23.7K	1
65	R64,R61	147983	RES, 1/4W, 5%, 470	2
66	R5	424721	RES, 2W, 5% 39K	1
67	R8	148130	RES, 1/4W, 5%, 22K	6
68	R60 & R80	148163	RES, 1/4W, 5%, 47K	2
69	R27	208389	RES, 3.3 MEG 5% 1/4W	1
70	R7	148189	RES, 1/4W, 5%, 100K	9
71	R52	188453	RES, 1/4, 5%, 680K	1
72	R51	220541	RES, 820K 1/4W 5%	1
73	R25, 53	148031	RES, 1/4W, 5%, 1.5K	2
74	R41	148049	RES, 1/4W, 5%, 2.2K	1
75	U23, 24	412726	RESISTOR NETWORK , 100K	2
76	R61 & 62	194944	RES 1/4W, 5% 10 MEG	2
77	K1	404061	RELAY #CR-3201-5-710	1
78	Q19	218396	TRANSISTOR 2N3904	1
79	S1	423129	SLIDE SWITCH DPDT	1
80	TP1, 2,3	170480	CONNECTOR, PLUG/JACK	3
81	J29	387316	SOCKET 14 PIN	3
82		406405	DECAL PART NO.	1
83	TP4-9	267500	CONNECTOR POST	6
84	R63	148023	RES 1/4W, 5% 1K	1
85	C20	424226	CAP 0.068uF, 10%, 50V	1
86	C22	255471	CAP 0.005uF, 100V	1
87	R71.75	218024	RES, 1/4W, 5%,750	2

7. R23, 55, 70, 73.74, 76, 77, 78, 79

6. INSTALL ITEM 82, MAKING SURE TO COVER ETCHED SIX DIGIT NO.

5. U15, 16, 17 & 18

4. Q1, 2, 3, 4, 5, 8, 9, 10, 12, 16, 17, 18, 20, 21 & 22, 30, 32, 33, 34, 35, 36

3. Q6, 7, 11, 15, 31

2. CR2, 7, 8 , 9 , 11 & 12

1. VR5, R11 & R13 ARE SUPPLIED AS A KIT.

9. C4, 5, 18 & 19

8. R9, 10, 15, 19, 45 & 57

7.

6. MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED, USING INKSTAMP (PERMA-DRI 177, OR EQUIV).

5. CLEAN ASSEMBLY PER S.O.P. 89.4.

4. TRIM LEADS TO .100 MAX LONG PER S.O.P. 89.19.

3. ASSEMBLE PER S.O.P. 111.8.

2. FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1628.

1. FOR SCHEMATIC DIAGRAM SEE 2200A-1028.

NOTES:

SEE SHEET 2 FOR ASSEMBLY DWG

REV	CHANGE DESCRIPTION	DR	CHK	APPR
A	RELEASED TO PRE PROD ITEM 5 WAS 363861; ITEM 16 WAS 376475, QTY 5; ITEM 17 WAS 357905, QTY 4; ITEM 29 WAS 413328, ITEM 51 WAS 275743; ITEM 65 WAS 188441, QTY 1; ITEM 66 WAS 110015; ITEM 71 WAS 188433, ITEM 79 WAS 386803, ITEM 83 WAS 277418 ADDED ITEM 5,62,85-87; COMBINED NOTES 13,16	G.F. 1/12		
	RELEASE TO PILOT	ARS 8/24/77	WALM 8/24/77	W.D. 8/24/77

PRELIMINARY NOTE

FLUKE JOHN FLUKE MFG CO INC
P O BOX 7428 SEATTLE WA
89536
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

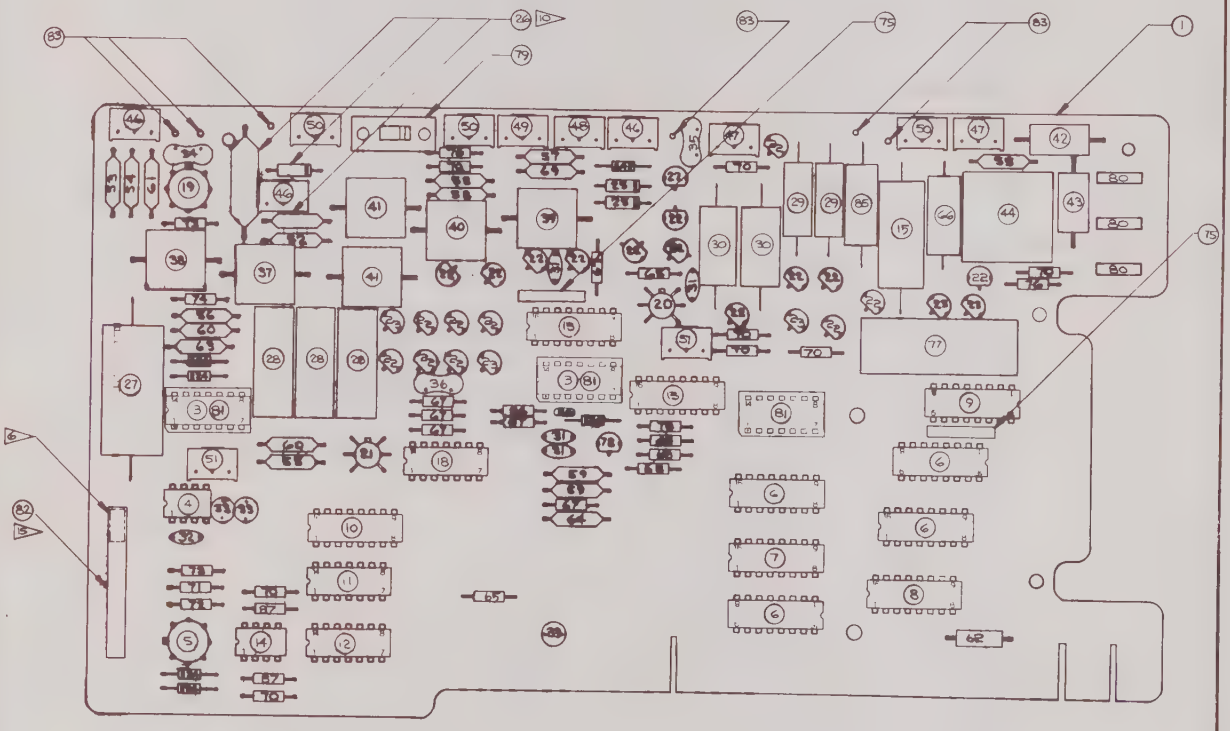
TOLERANCES

XX ± .020	100 DIA	.003 .002
XXX ± .010	101 .500 DIA	.006 .002
ANGLES ±	501 1.00 DIA	.008 .003
FC	1.01 1.00 DIA	.010 .005

DR	T. MOREY	7/6/75
CHK	M. SHAREE	8/22/75
ENG	[illegible]	8-2-77
ENG	[illegible]	8-2-77
MATERIAL		
FINISH		

1uV A/D PCB ASSEMBLY

PART NO	SIZE	DRAWING NO
409409	D	2200A-4028
SCALE —	SHT 1 OF 2	REV A



SEE SHEET 1 FOR PARTS LIST & NOTES

— SEE SHEET 1 FOR REV —

REV	CHANGE DESCRIPTION	DR	CHK	APPR

PROPRIETARY NOTICE

This document and the technical data herein disclosed are proprietary to John Fluke Mfg Co. Inc. and shall not, in whole or in part, without written permission of John Fluke Mfg Co. Inc. be used (reliance or otherwise) in any manner detrimental to the interests of John Fluke Mfg Co. Inc. nor used for manufacture by anyone other than John Fluke Mfg Co. Inc. No information herein will been developed at private expense, and may only be used for purposes of evaluation, design, procurement or construction specifically authorized in writing by John Fluke Mfg Co. Inc.

FLUKE | JOHN FLUKE MFG CO INC
P O BOX 7428 SEATTLE WA
89536
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

TOLERANCES

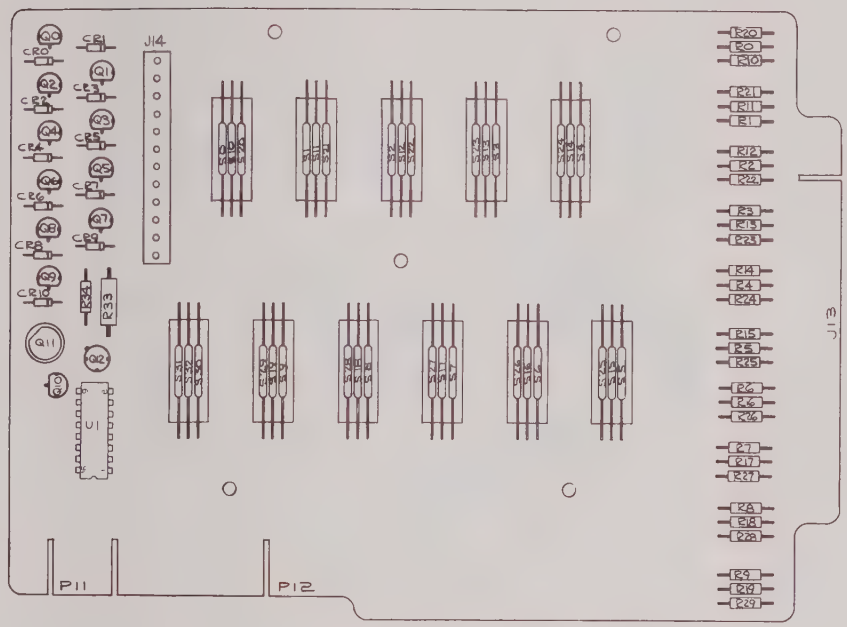
XX ± .020	.000 - 100 DIA	+ .003 - .003
XXX ± .010	101 - 200 DIA	+ .004 - .002
ANGLES ± ½°	201 - 500 DIA	+ .006 - .003
	501 - 1.00 DIA	+ .010 - .005

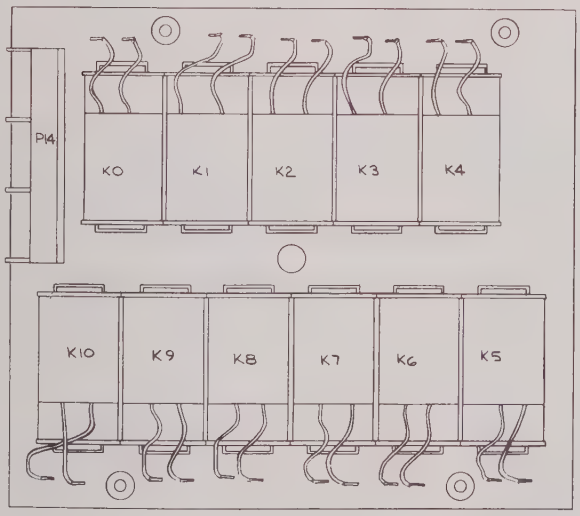
DR	T. MOREY	8/18/75
CHK	M. SHAWES	8-22-75
ENG		8-22-75
ENG		8-22-75
MATERIAL		
FINISH		

1uV A/D PCB ASSEMBLY

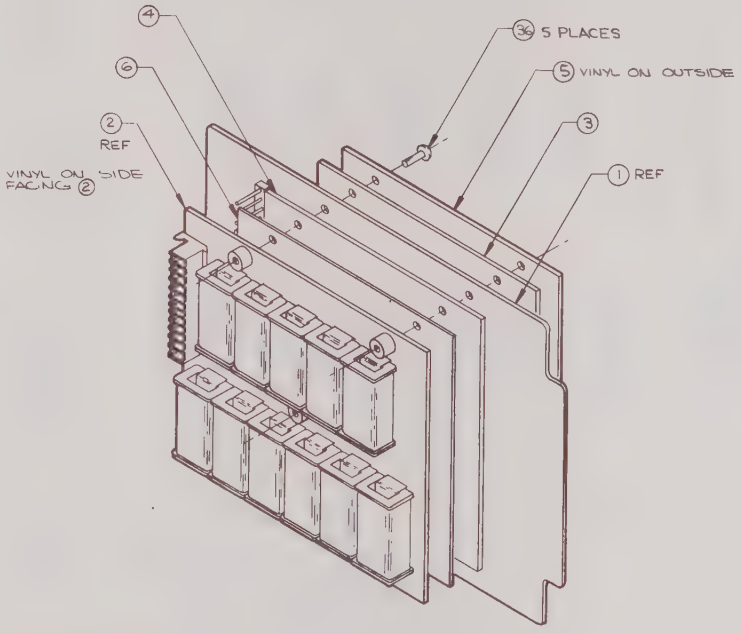
PART NO.	SIZE	DRAWING NO.
409409	D	2200A-4028

SCALE 2/1 | SHT 2 OF 2 | REV A





	RELEASED TO PRE-PROD			
—	RELEASED TO PILOT			
FLUKE 89536	MOREY	72275	1uV SCANNER REFERENCE DESIGNATION DWG	
			D	2200A-1629



ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		409276	1 MICROVOLT REED PCB	1
2		409334	COIL PCB	1
3		412320	BOTTOM SPACER	1
4		412312	TOP SPACER	1
5		412296	TOP SCANNER SHIELD	1
6		412304	BOTTOM SCANNER SHIELD	1
7				
8				
9				
10	R33	109165	RESISTOR 1/2W, 5% 10K	1
11	R0-29&30	147983	RESISTOR 1/4W, 5% 470Ω	31
12				
13				
14				
15	CR0-10	203323	DIODE 1N4148	11
16				
17				
18	Q0-Q9	195974	TRANSISTOR 2N3906	10
19	Q11	182196	TRANSISTOR 2N3643	1
20	Q10	218396	TRANSISTOR 2N3904	1
21	Q12	357905	TRANSISTOR #F2690	1
22				
23				
24	U1	407981	IC #MM74C42N	1
25				
26				
27				
28	K0-10	380709	REED RELAY COIL	11
29	S0-32	380717	DRY REED SWITCH	33
30				
31				
32		380451	METAL STRIP	11
33	P14	380691	PCB CONNECTOR	1
34	J14	380683	CONTACT PIN	1
35		152207	XISTOR MTG, SPACER	1
36		152181	SCREW 6-32 X 5/8 LONG	5
37		276535	SOCKET, 16 PIN	1

8. TO PREVENT FIELD FAILURES WHICH ARE NOT DETECTABLE IN TEST, HANDLE (2) AS FOLLOWS. DO NOT BEND LARGE LEADS WHICH ENTER THE GLASS ENVELOPE. REED SWITCH UNUSABLE IF LARGE LEADS ARE BENT.

▽ HAND SOLDER ITEM 28 & 29 AS INDICATED.

▷ MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177, OR EQUIVALENT).

5. SPECIAL CLEANING REQUIREMENTS
FINAL WASH ASSY TO REMOVE SALTS PER 6.2.5 OF S.O.P. 89.16. AFTER WASH HANDLE ASSY SUCH THAT CIRCUITRY WOT BE HANDLED WITH BARE HANDS. PACKAGE ASSY IN PLASTIC BAGS OR EQUIVALENT TO PREVENT LATER CONTAMINATION.

4. TRIM LEADS TO .100 MAX. LONG
3. ASSY PER S.O.P. 111.8.
2. FOR REFERENCE DESIGNATION DRAWING SEE 2200A-1629.
1. FOR SCHEMATIC DIAGRAM SEE 2200A-1029.

NOTES:

SEE SHEET 2 FOR ASSEMBLY DRAWING

REV	CHANGE DESCRIPTION	DR	CHK	APPR
	RELEASED TO PRE-PROD	BM 7-22-76	RP	RB
A	COMPLETELY REV NOTE 5&8 NOTE 4 WAS PER SOP 89.19 ADDED ITEM 37; ITEM 10 WAS 148106; REV SCREEN	BM 9-6-76	RP	RB
—	RELEASED TO PILOT	BM 7-26-77	RP	RB

PROPRIETARY NOTICE

JOHN FLUKE MFG CO., INC
P O BOX 7428 SEATTLE WA

89536

DO NOT SCALE DRAWING
DIMENSIONS IN INCHES

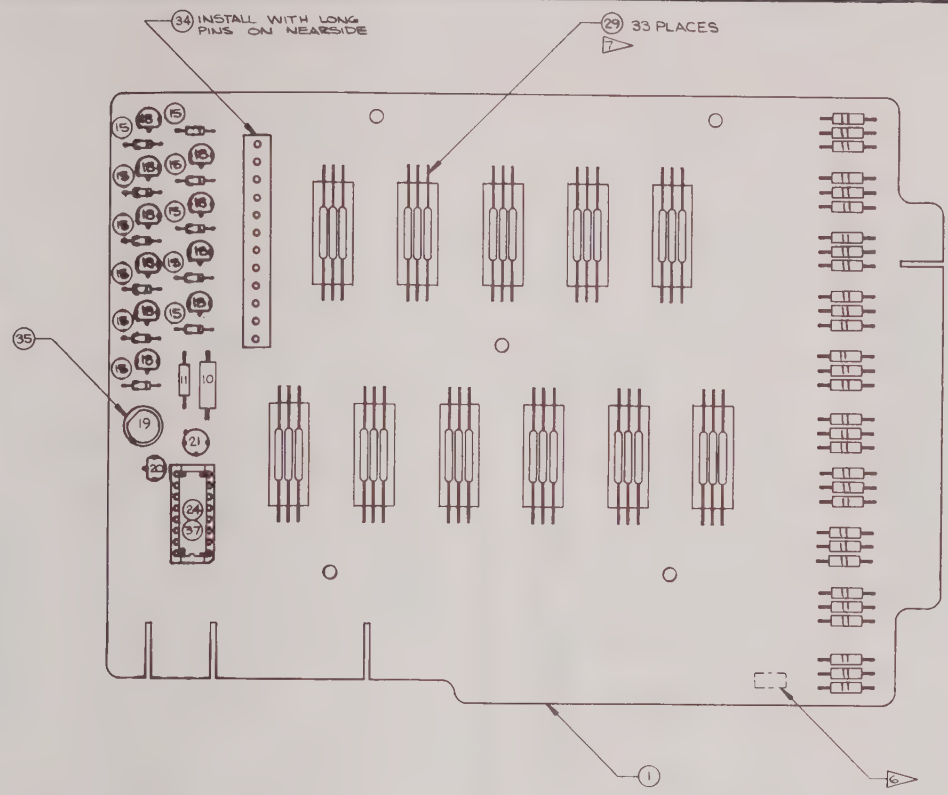
TOLERANCES
XX ± .020
XXX ± .010
ANGLES ±
%

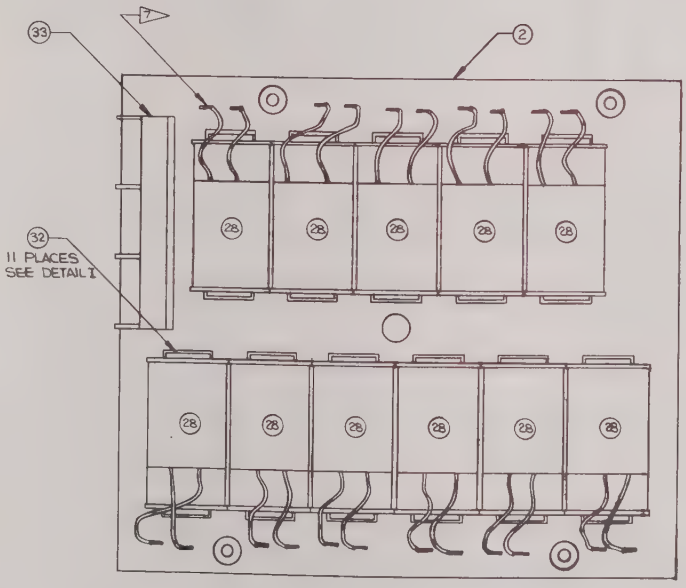
.000 100 DIA ± .003 .007
.101 .700 DIA ± .004 .007
.701 .500 DIA ± .006 .003
.501 1.00 DIA ± .010 .005

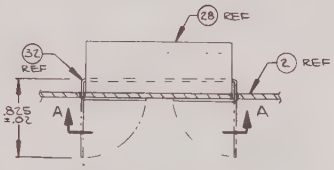
DR MOREY
CHK F. EDELMAN
ENG
ENG
MATERIAL
FINISH

1mV SCANNER ASSEMBLY

PART NO	SIZE	DRAWING NO
409417	D	2200A-4029
SCALE	SHT 1 OF 2	REV A

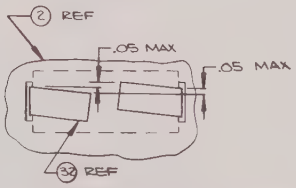






BEND ITEM 32 TO ASSEMBLE AS SHOWN SUCH THAT ITEM 28 IS TIGHTLY HELD TO ITEM 2.

DETAIL I



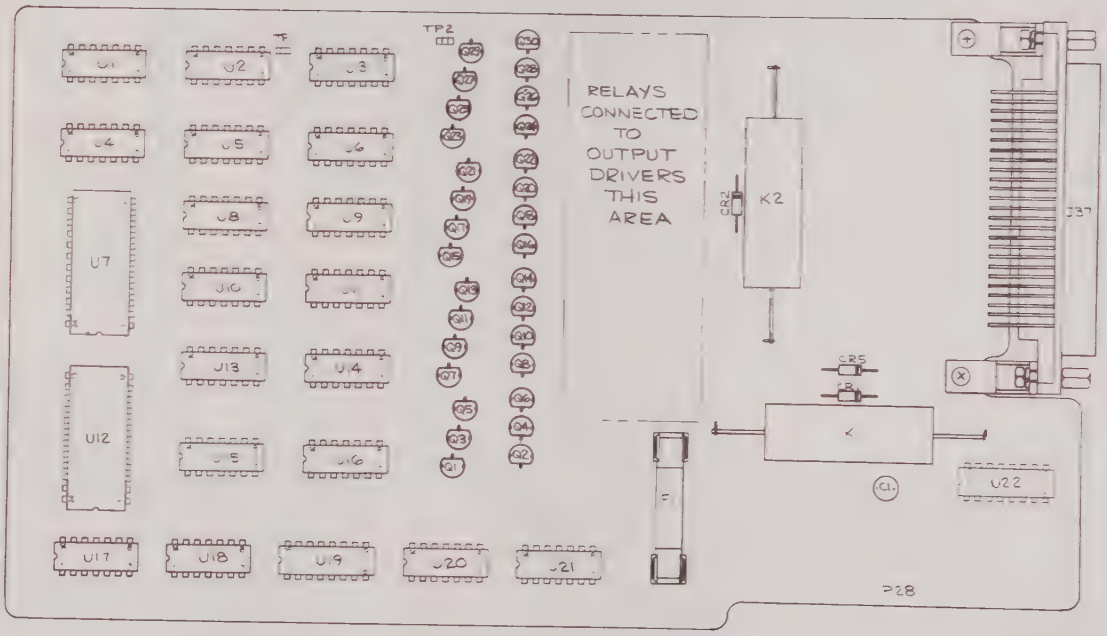
ALIGNMENT OF 32 BENT INTO POSITION IS NOT TO EXCEED DIMENSIONS SHOWN

VIEW A-A

SEE SHEET 1 FOR PARTS LIST & NOTES

— SEE SH 1 FOR REV —

FLUKE	JOHN FLUKE MFG. CO. INC. P.O. BOX 7428 SEATTLE WA	DR	KOKEY	7-23-79	1 μV SCANNER ASSEMBLY
89536	DO NOT SCALE DRAWING DIMENSIONS IN INCHES	CHK		9-5-79	
		ENG		8-6-79	
		ENG		8-13-79	
	TOLERANCES	MATERIAL		PART NO. 409417	SIZE D DRAWING NO. 2200A-4029
		FINISH		SCALE 2X1	SHT 2 OF 2 REV A



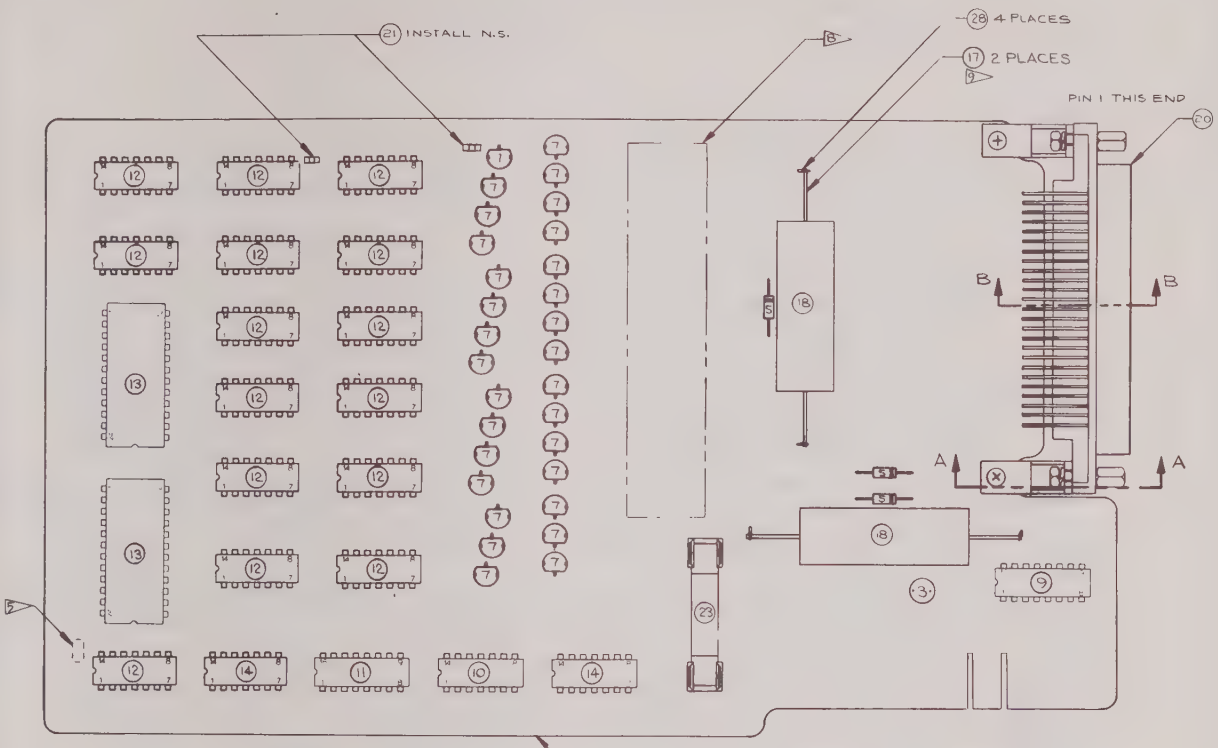
NOTES:
1 FOR ASSEMBLY DRAWING SEE 2240A-4031.
2 FOR SCHEMATIC DIAGRAM SEE 2240A-1031.

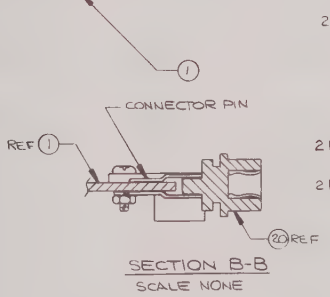
	RELEASED TO PRE PROD		
A	REV TP1 LOC., ADDED TP2		
	RELEASED TO PILOT RUN		
REV	CHANGE DESCRIPTION	DR	CHK

JOHN FLUKE MFG CO INC
P O BOX 1428 SEATTLE WA
89536
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES
TOLERANCES
DR MOBEY
CHK
ENG
ENG
MATERIAL
FINISH

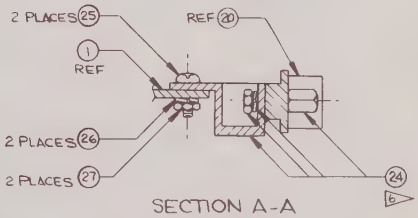
REFERENCE DESIGNATION DWG, ALARMS OUTPUT

PART NO.	SIZE	DRAWING NO.
—	D	2240A-1631
SCALE —	SHT	OF





SECTION B-B
SCALE NONE



SECTION A-A
SCALE: NONE

ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		411843	PCB, ALARMS OUTPUT	1
2				
3	C1	176214	CAP, TANT 10uF	1
4				
5	CR1, 2, 5	203323	DIODE IN4148	3
6				
7	Q1 30	330603	TRANSISTOR MPS6560	30
8				
9	U22	355417	I.C. #4010	1
10	U.0	355198	I.C. #4011	1
11	U19	355230	I.C. #4027	1
12	▷	340117	I.C. MC 14013_	15
13	U7, 12	414342	I.C. CD4514B	2
14	U18, 21	355172	I.C. #4001	2
15				
16				
17	K1, 2	413294	REED SWITCH	2
18	K1, 2	268357	COIL, REED 6V, 150Ω	2
19				
23	J7	414417	CONNECTOR 64 POS.	1
24	TP1,2	267500	CONNECTOR POST	2
25				
26	F1	205514	FUSE 1/4 AMP	1
27		417334	CONNECTOR HDW. KIT	1
28		150124	SCREW 4-40 X 3/8 PHP	2
29		200345	LOCKWASHER #4	2
30		249111	NUT 4-40	2
28		115477	WIRE, BUS #24	.34FT

3 TO PREVENT FIELD FAILURES WHICH ARE NOT DETECTABLE IN TEST, HANDLE (17) AS FOLLOWS. DO NOT BEND LARGE LEADS WHICH ENTER THE GLASS ENVELOPE. REED SWITCH UNUSABLE IF LARGE LEADS ARE BENT. MAKE SERVICE LOOP IN SMALL LEAD WHICH ATTACHES TO PCB PRIOR TO SOLDERING.

8 MASK AREA SHOWN ON CKT 1 SIDE PRIOR TO FLOW SOLDERING.

7 U1-6 4-11, 13-17

6 PARTS INDICATED ARE SUPPLIED IN (24) HARDWARE KIT.

5 MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED USING INKSTAMP (PERMA-DRI 177 OR EQUIV.).

4 CLEAN ASSEMBLY PER S.O.P. 89.4.

3. TRIM LEADS TO .100 MAX. LONG

2. ASSEMBLE PER S.O.P. 111.8.

1. FOR SCHEMATIC DIAGRAM SEE 2240A-1031, FOR REFERENCE DESIGNATION DRAWING SEE 2240A-1631.

NOTES:

REV	CHANGE DESCRIPTION	DR	CHK	APPR
	RELEASED TO PRE PROD.			
B	(21) QTY WAS 1, REV NOTE 9			
	RELEASED TO PILOT RUN			
A	ADDED NOTE 8 & ITEM 28			

PROPRIETARY NOTE

FLUKE 89536

JOHN FLUKE MFG CO INC
P O BOX 7428 SEATTLE WA
DO NOT SCALE DRAWING
DIMENSIONS IN INCHES.

TOLERANCES

DR T MOREY 8/15/75
CHK G SCHILLING 8/25/75
ENG [illegible]
ENG [illegible]

MATERIAL

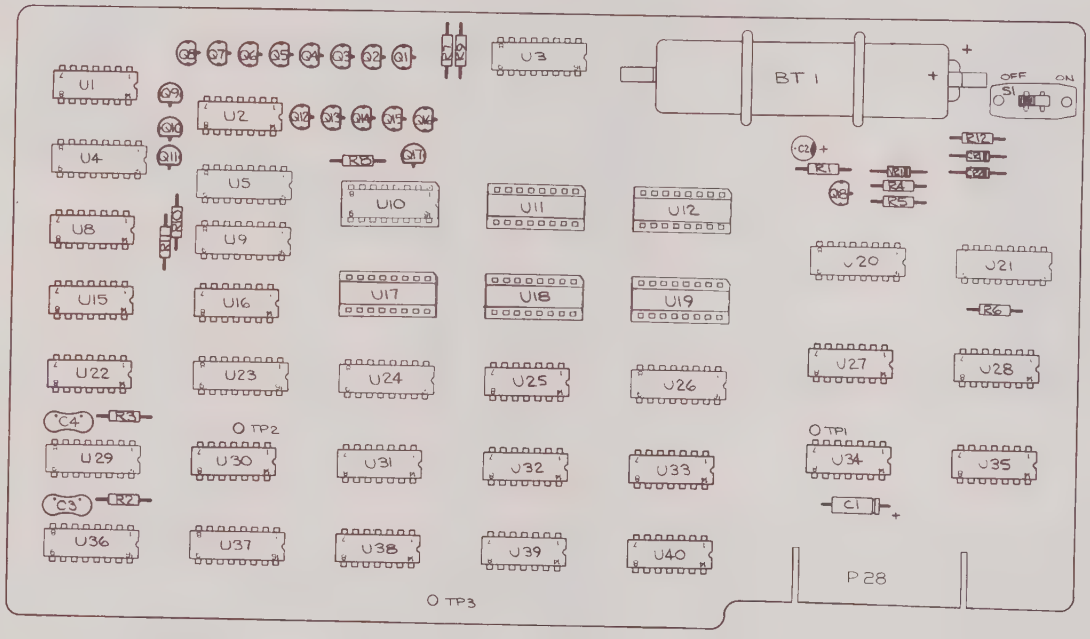
FINISH

ALARMS OUTPUT ASSEMBLY

PART NO	SIZE	DRAWING NO
411850	D	2240A-4031

SCALE 2 X 1 SHT 1 OF 1 REV B

NOTES:
UNLESS OTHERWISE SPECIFIED
1. FOR ASSEMBLY SEE 2240A-4032.
2. FOR SCHEMATIC DIAGRAM SEE 2240A-1032.



When ordering replacement parts for U10, U11, U12, U17, U18 or U19 specify part number 418079.

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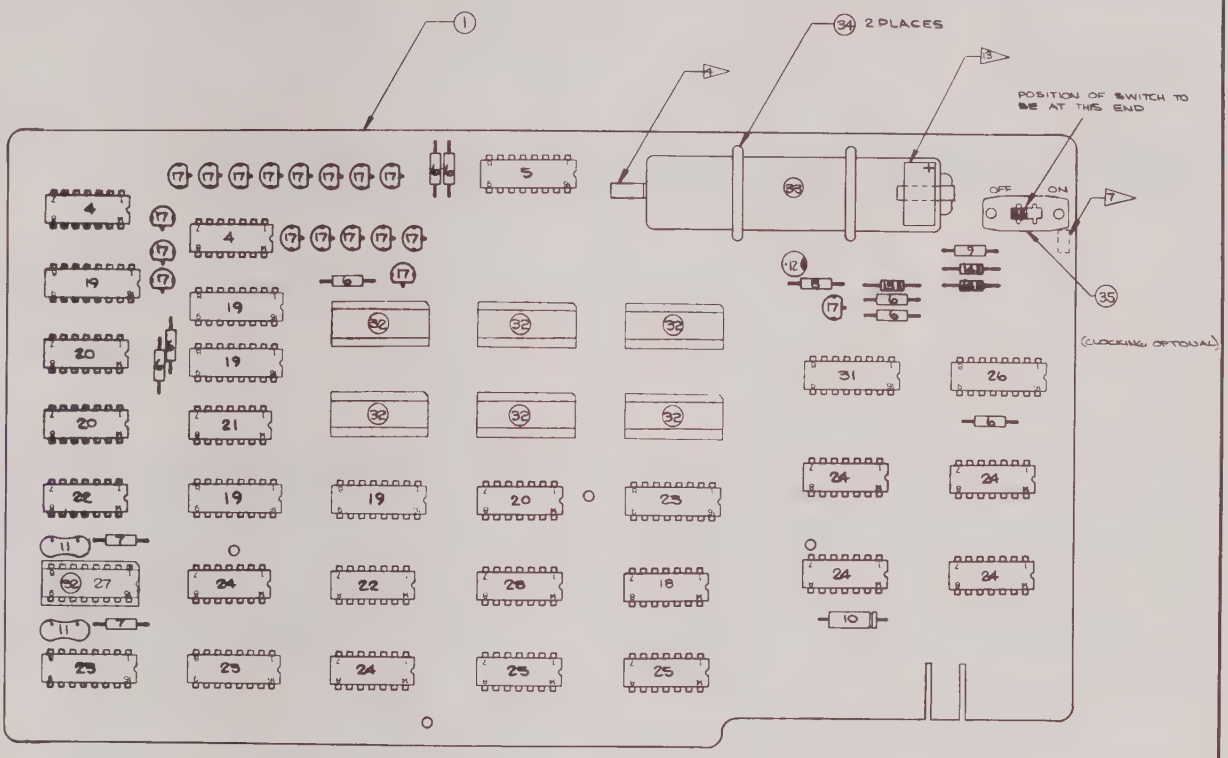
FLUKE	JOHN FLUKE MFG CO INC P O BOX 7428 SEATTLE WA	DR T MOREY	5/1/75
89536	DO NOT SCALE DRAWING DIMENSIONS IN INCHES	CHK M SHAVER	7-11-75
TOLERANCES		ENG LPD	7-11-75
MATERIAL		ENG	7-14-75
FINISH			

RELEASED TO PRE-PROD
RELEASED TO PILOT RUN

REF. DES. DWG. RANGE & FUNCTION MEMORY

PART NO	SIZE	DRAWING NO.
	D	2240A-1632
SCALE 2/1	SHT	REV



ITEM	REF DES	P/N	NOMENCLATURE	QTY
1		412429	R & F MEMORY PCB	1
2				
3				
4	U1, U2	364000	RES NETWORK, 1.5W, 5%, 10K OHM	2
5	U3	355305	RES NETWORK, 1/4W, 5%, 10K OHM	1
6	R4-R11	148106	RESISTOR, 1/4W, 5%, 10K OHM	8
7	R2, R3	291872	RESISTOR, 1/8W, 1%, 20K, MF	2
8	R1	193482	RESISTOR, 1/4W, 5%, 200 OHM	1
9	R12	148023	RESISTOR, 1/4 W, 5%, 1K	1
10	C1,	170266	CAPACITOR, 25VDCW, 10uF	1
11	C3, C4	148528	CAPACITOR, 500 WVDC, 56 PF	2
12	C2	330662	CAPACITOR, 10 uF	1
13				
14	CR1, CR2	203323	DIODE, IN4148	2
15	VR1	340695	ZENER DIODE, 1W, 5%, 10V	1
16				
17	Q1-Q18	218396	TRANSISTOR, 2N3904	18
18	U33	355206	I.C., #4012	1
19	[8]	355214	I.C., #4009	5
20	[9]	375147	I.C., #4023	3
21	U16	355180	I.C., #4025	1
22	U31-U22	355198	I.C., #4011	2
23	[10]	355230	I.C., #4027	3
24	[11]	340117	I.C., MC14013L	6
25	U39, U40	355172	I.C., #4001	2
26	U21	407759	I.C., MM80C97N	1
27	U29	355412	I.C., #4010	1
28	U32	363820	I.C., #4002	1
29				
30				
31	U20	414078	I.C., #4035	1
32		276535	I.C. SOCKET	7
33	B11	408286	LITHIUM BATTERY, 5.6V, 1 AMP HR	1
34		104794	RUBBER STRAP	2
35	S1	386813	SLIDE SWITCH	1

[13] BEND BACK POSITIVE LEAD OF ITEM 33 APPROX. AS SHOWN. TAPE IN POSITION USING 954735 MYLAR TAPE.

[11] U27, U28, U30, U34, U35 & U38.

[10] U26, U36 & U37.

[9] U8, U15 & U25.

[8] U4, U5, U9, U23 & U24.

[7] MARK ASSEMBLY REVISION LETTER IN SPACE PROVIDED, USING INKSTAMP (PERMA-DRI 177, OR EQUIVALENT).

6. CLEAN ASSEMBLY PER S.O.P. 89.4.
5. TRIM LEADS TO .100 MAX. LONG
[4] HAND SOLDER ITEM (33) AS INDICATED.
3. ASSEMBLE PER S.O.P. 111.8.
2. FOR REFERENCE DESIGNATION DRAWING, SEE 2200A-1632.
1. FOR SCHEMATIC DIAGRAM, SEE 2200A-1032.

NOTES:

REV	CHANGE DESCRIPTION	DR	CHK	APPR
	RELEASED TO PRE-PROD			
A	ADDED NOTE 13 NOTE 5 WAS: PER SOP 89.19 REVISED ITEM 32 WAS: 387324 QTY 6 DELETED ITEM 30 NOTE 12			
	RELEASED TO PILOT RUN			

PROPRIETARY NOTICE

FLUKE | JOHN FLUKE MFG CO., INC. P.O. BOX 7428 SEATTLE WA | 89536 | DO NOT SCALE DRAWING. DIMENSIONS IN INCHES | TOLERANCES

DR	T. MOREY 5/9/75
CHK	W. SHAVER 7-11-75
ENG	7-11-75
ENG	7-14-75
MATERIAL	
FINISH	

R&F MEMORY ASSEMBLY

PART NO	SIZE	DRAWING NO
412437	D	2240A-4032

SCALE 2/1 | SHT 1 OF 1 | REV A

Section 6

Option & Accessory Information

This section of the manual contains the information necessary to install, operate, and maintain the options and/or accessories which are available for use with the Model 2240A Data Logger. The information provided is divided into subsections, which each option comprising a subsection, and the accessories as a whole comprising a subsection. The location of a particular subsection is facilitated by the use of unique page and paragraph numbering which corresponds to the option or accessory in question. For example, a 600-x series identifies the accessory subsection and a 605-x series identifies the subsection for the –05 Option (where x is the sequential page or paragraph numbers). The available options, as well as those not used, are identified in the following table of contents. Detailed schematics, when applicable, are included in Section 8, Schematic Diagrams.

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M00-280-610	Rack Slide Kit	600-1
2200A-7005	Service Extender Cable Set.	600-1
2200A-7006	General Purpose Interface Cable	600-2
2200A-7007	Interface Connector (50 pin)	600-2
2201A	Scanner Extender Chassis	600-2
	OPTIONS	
–01	Not Used	
–02	Not Used	
–03	Not Used	
–04	Not Used	
–05	General Purpose Scanner	605-1
–06	Low Level Scanner	606-1
–07	Solder Pin Connector	607-1
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–17	Not Used	
–18	Not Used	
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–22	Alarm Set, 15 Single Limits	622-1
–23	Alarm Set Point Output	623-1

ACCESSORIES

600-1. RACK MOUNTING KIT (M07-205-600)

600-2. The 2200A/2240A can be rack-mounted in a standard 19-inch equipment rack using Rack Mounting Kit M07-205-600. Use the following procedure to install the kit.

a. Peel off the name plate decals from the front side-corners of the 2200A/2240A.

b. Remove the front corner screws which match the hole pattern in the rack-mounting ears (See Figure 600-1).

c. Attach the rack-mounting ears to the front corners of the unit using the screws supplied in the rack-mounting kit.

600-3. RACK SLIDE KIT (M00-280-610)

600-4. The 2200A/2240A can be rack-mounted in a 24-inch deep equipment rack using the Rack Slide Kit M00-280-610. Use the following procedure to install the kit:

a. Remove the horizontal side trim decal from both sides of the 2200A/2240A.

b. Refer to Figure 600-2, and, using the screws supplied with the kit, attach the Chassis Section (B) of the slide kit to each side of the unit. Use the center row of mounting holes.

c. Install the cabinet Section (D) and the Center Section (C) in the equipment rack.

d. Pull the Center Section of the slide out through the front of the equipment rack until it locks in the extended position.

e. Depress the spring locks on the Chassis Section (B) and join section B and C.

f. Push the instrument into the equipment rack and then pull it out to the extended position. The spring locks should limit the rack slide travel.

600-5. SERVICE EXTENDER CABLE SET - (2200A-7005)

600-6. A set of two service extender cables is available for use in servicing any one of the data logger's vertical plug-in pcbs. The majority of the pcb's require the use of only one extender. However, some of the pcbs, such as the A/D Converter, require the use of both extenders.

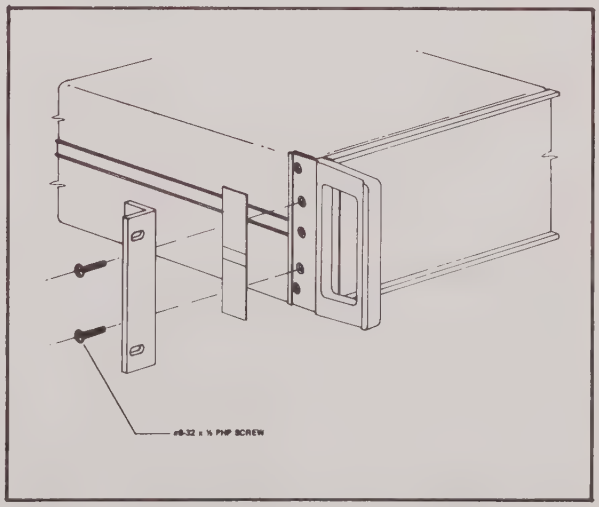


Figure 600-1. RACK MOUNTING KIT

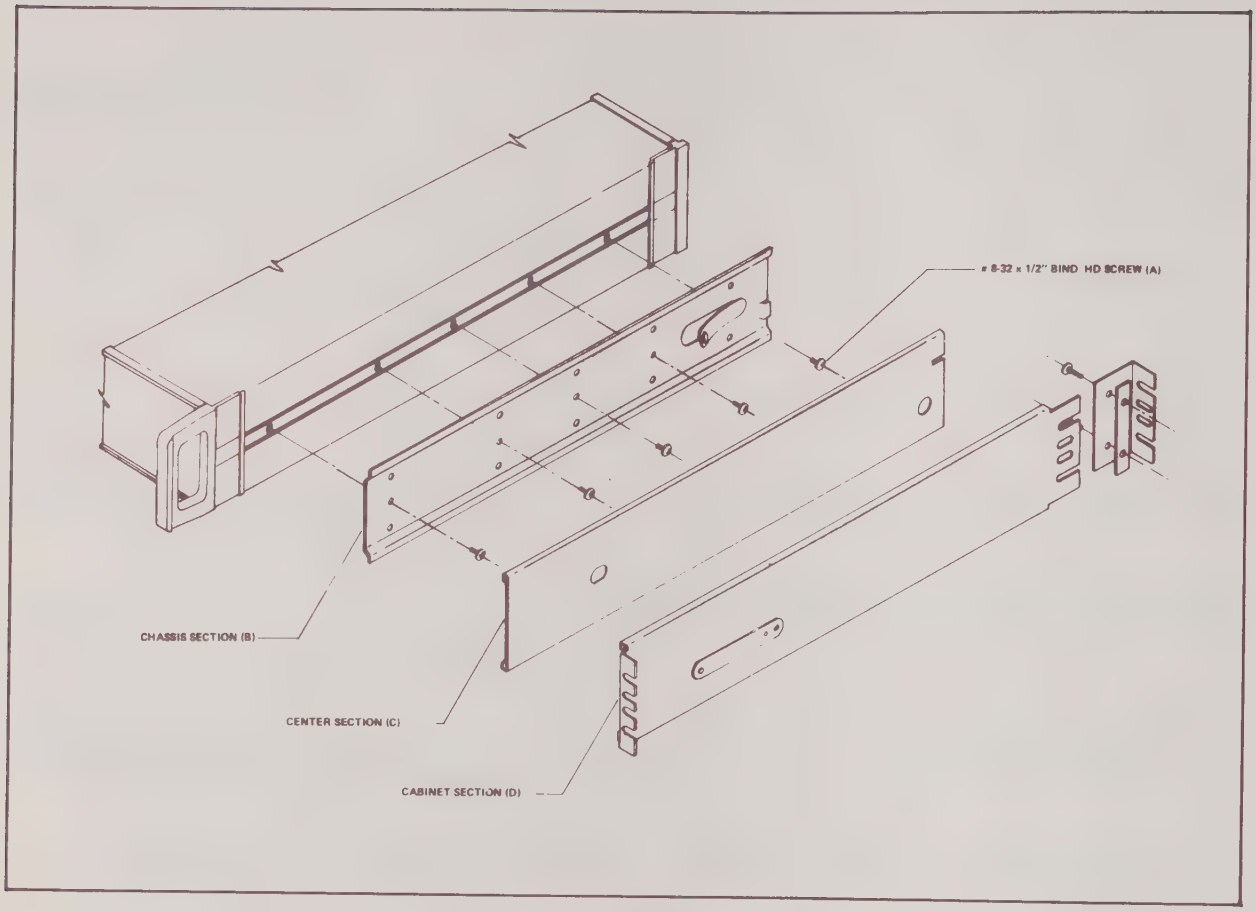


Figure 600-2. RACK SLIDE KIT

600-7. GENERAL PURPOSE INTERFACE CABLE (2200A-7006)

600-8. The General Purpose Interface Cable is designed for use in fabricating custom I/O cables for the Digital Input Option (−16) and the Alarm Set-Point Output Option (−23). The cable assembly consists of a 6-foot, 50-wire cable and a 50-pin connector. The connector is attached to one end of the cable and is designed to mate with the rear-panel connectors on Options −16 and −23. The user is responsible for completing the connections at the free-end of the cable Refer to the appropriate option (−16 or −23) in this section of the manual for the necessary connector pin assignments.

600-9. INTERFACE CONNECTOR (2200A-7007)

600-10. The Interface Connector is designed for use in fabricating custom I/O cables for the Digital Input Option (−16) and the Alarm Set-Point Option (23). The connector assembly consists of a blank 50-pin connector and a hood. The user is responsible for the remainder of the cable. Refer to the appropriate option (−16 or −23) in this section of the manual for the necessary connector pin assignments.

600-11.2201A SCANNER EXTENDER CHASSIS

600-12.Introduction

600-13. The 2201A Scanner Extender Chassis shown in Figure 600-3 is a mechancial housing that extends the scanner capacity of the data logger by up to 120 channels; i.e., slots for 12 additional option −05 or −06 scanners are provided. The 2200A and 2240A Data Loggers are capable of servicing a maximum of 100 and 1000 channels, respectively. However, their scanner capacity is physically limited to 60 channels. Therefore, to establish the capacity for a full complement of channels, one or more 2201A's are required.

600-14. Each 2201A is equipped with a cable assembly that allows two or more units to be connected in a serial or a "daisy chain" fashion. (The first unit in the chain is connected to the data logger.) These cables carry the channel select commands, (0 through 999), the analog signal from the selected channel, the reference and sense lines necessary to make thermocouple measurements, and the +5V dc needed to power each 2201A. A total of 100 mA is available from the 5 volt supply. Less than 1 mA is required to operate the 2201A when no channel relays are operated.

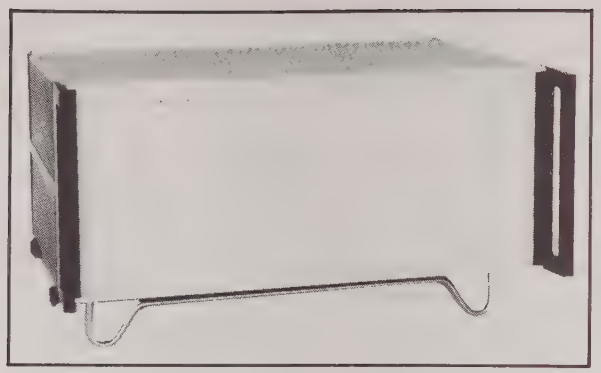


Figure 600-3 2201A SCANNER EXTENDER CHASSIS.

600-15. Installation

600-16. The 2201A is designed as a bench-top instrument. However, by installing either the rack-mounting kit or the rack-slide kit, described earlier in this section, the unit can be mounted in a standard 19-inch equipment rack.

600-17 CHANNEL ADDRESS ASSIGNMENTS

600-18. Prior to operation, the Channel-Identification Code must be assigned to the 2201A. This code is used to define the channel addresses for the scanner slots contained in each 2201A and is independent of the units' position in the control chain. The code is entered on two thumb-wheel switches located under the 2201A's top cover. The switches are manually set to identify the first channel to occur in SLOT 0. Consecutive channel addresses are automatically assigned to the remaining scanner slots (1 through 11). The location of the the Channel Identification switches and the channel assignments that result from a switch setting of 06 (Channel 060. The units digit is always zero and cannot be set.) are shown in Figure 600-4. Use the following procedure to set the Channel Identification Code switches in each 2201A:

NOTE

Overlapping or redundant Channel Identification Codes should be avoided. Otherwise, channels with like assignments will be operated simultaneously, when commanded.

a. Remove the top cover from the 2201A.

b. Refer to Figure 600-4 and locate the Channel-Identification Switches.

c. Set the Hundreds switch to the MSD of the desired three-digit address code (100, 200, 300, etc.). If less than 100 set it to zero.

d. Set the Ten's switch to the second digit of the three-digit address code (000, 010, 020, 030, etc.). The least significant digit of the address code cannot be set and is always zero.

e. Install the top dust cover.

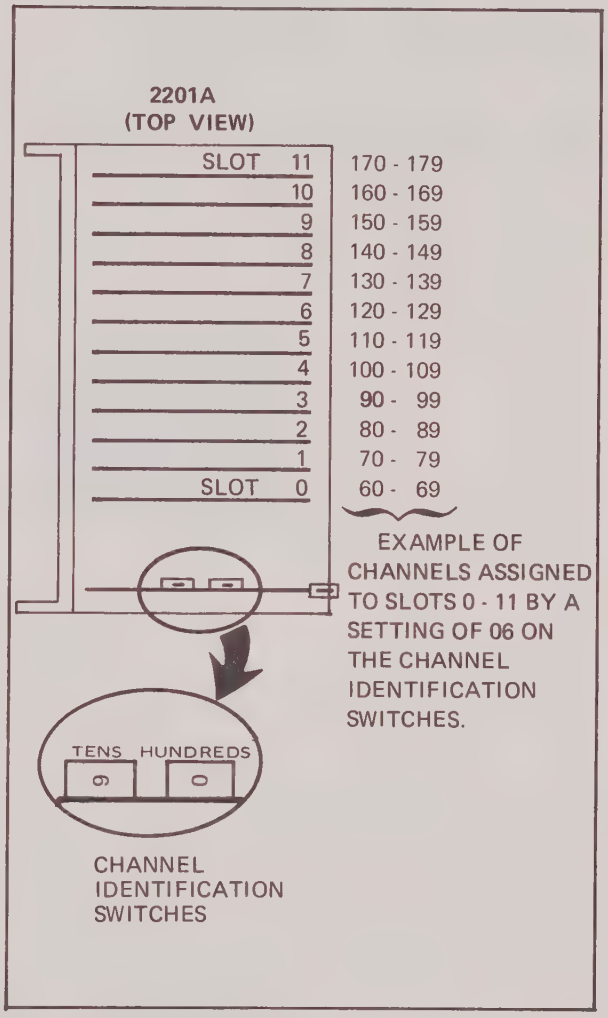


Figure 600-4. 2201A CHANNEL ADDRESS SWITCH LOCATIONS AND EXAMPLE OF SWITCH SETTINGS.

600-19. CONTROL CABLE CONNECTIONS

600-20. Each 2201A is equipped with a rear-input control cable. Interconnect the data logger and one or more 2201A's as shown in Figure 600-5. Connector J4 on the last unit in the chain is not used.

600-21. SCANNER PCB's

600-22 Refer to the Option –05 and –06 subsections in Section 6 of this manual for scanner pcb installation instructions. Install the appropriate scanners in the desired slots.

600-23. INPUT CONNECTORS

600-24. Refer to the Option–07 and –08 subsections in Section 6 of this manual for scanner input connector installation instructions. Install the input connectors in the desired slots.

600-25. Operation

600-26. Once installed, the 2201A requires no operator attention. Instructions for programming the operation of all scanners from the data logger's front panel are included in Section 2 of this manual.

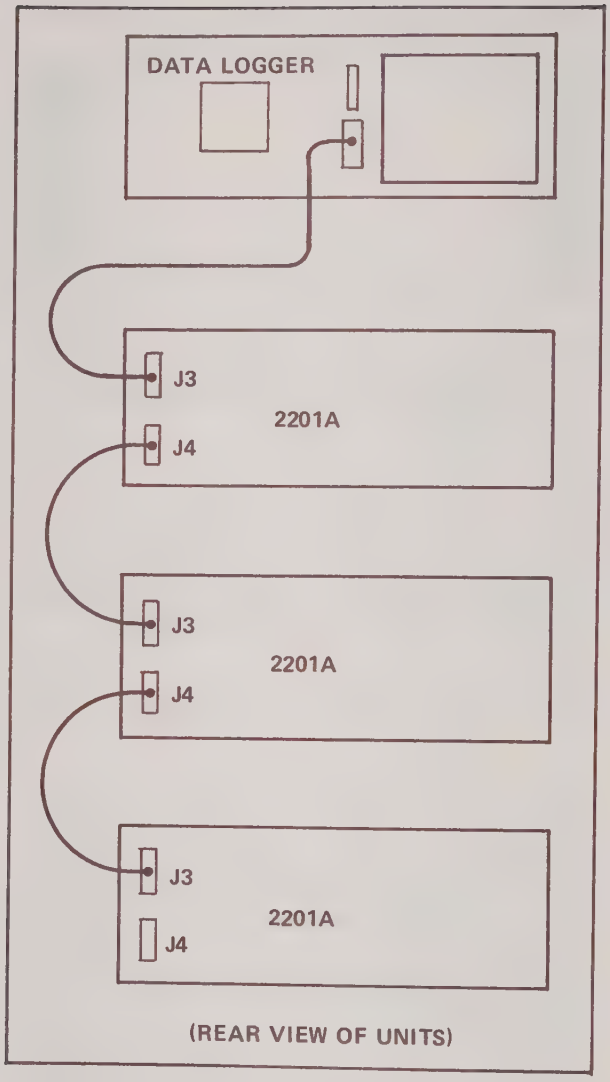


Figure 600-5 2201A CONTROL CABLE CONNECTIONS.

GENERAL PURPOSE SCANNER OPTION –05

605-1. INTRODUCTION

605-2. The General Purpose Scanner (Option –05) is a programmable relay-switch module designed to operate as a plug-in option in any one of the scanner block slots in a 2200 series Data Logger/Scanner Extender (hereafter referred to collectively as data logger). The –05 scanner contains 12 form-A reed relays; 11 double-pole and 1 single-pole. A contact pair from each double-pole relay is connected to two separate busses (one pole to each bus) to form a 2-pole 10-channel scanner, complete with treeing relay. The treeing relay operates when any one of the channel relays is operated, and connects the scanner busses to the input of the A/D Converter. When the scanner is idle, the open treeing relay isolates the scanner capacitance from the input of the A/D converter. The single-pole relay operates in parallel with the treeing relay, and connects the scanners unique shield (So) to the guard on the A/D converter.

605-3. SPECIFICATIONS

605-4. Specifications for the General Purpose Scanner are contained in Section 1 of this manual.

605-5. INSTALLATION

605-6. The General Purpose Scanner mounts in any one of the available scanner-block slots provided in the data logger, as shown in Figure 605-1. Install the scanner as follows:

WARNING!

Remove line-power and all other high voltage inputs to the data logger before starting this procedure.

a. Remove the top dust cover from the data logger.

b. Remove the large top-inner cover located in the left-rear of the unit (as viewed from the top front).

CAUTION!

Handle the scanner pcb by its edges to avoid contaminating the pcb with oil from the hands. The use of gloves is recommended.

c. Select the slot that includes the block of channels the scanner is to represent, and align the scanner in the slot so that the large board-edge connector is toward the rear of the unit, and the small offset board-edge connectors are toward the bottom of the unit. Push the scanner straight down onto the mating connectors.

d. After the desired number of scanners are installed, install the large left-rear inner cover.

e. Install the top dust cover.

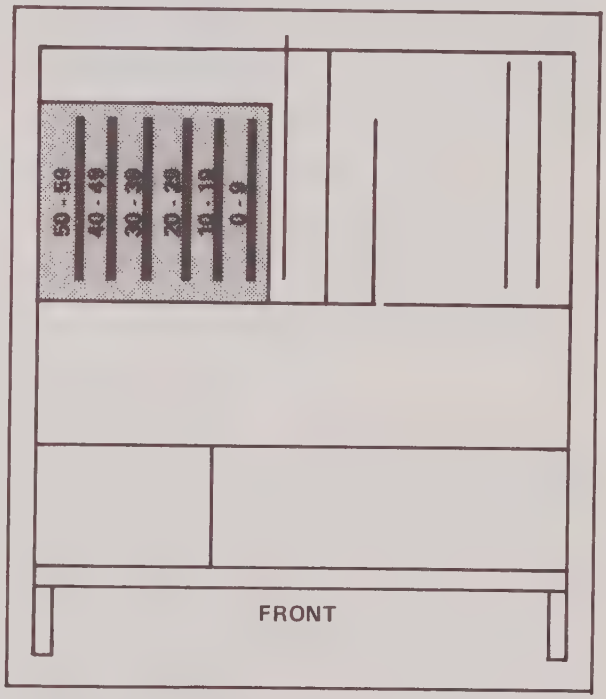


Figure 605-1. SCANNER MOUNTING LOCATIONS

605-7. OPERATION

605-8. Once installed in the data logger, the General Purpose Scanner requires no operator attention. However, certain considerations are necessary to properly interface the scanner with remote stimulus data. These considerations are covered in the following paragraphs.

605-9. Input Connections

605-10. Analog interface connections with the General Purpose Scanner are completed through either one-of-two types of connectors which attach to the scanner module connectors at the rear of the data logger. The connectors are available as options, and include: the Solder Pin Connector (Option –07) and the Isothermal Block Connector (Option

–08). The Solder Pin Connector is a general purpose assembly which consists of a 44-pin connector with solder-type cable connections. A clam-shell housing provides strain relief for the cable, and protection of the connector contacts. The Isothermal Block Connector is required for thermocouple inputs. It features an Isothermal block with screw-type connectios, and a temperature sensing circuit. The temperature sensing circuit allows the measurement system to compensate for temperature changes that occur on the isothermal block

605-11. Input Pin Assignments

605-12. The pin assignments for the rear-panel connector of the General Purpose Scanner are shown in Fgiure 605-2. Since contact with these signals is completed through one-of-two connector assemblies (Option –07 or –08) refer to the appropriate option subsection for pin assignments as available for fabricating interface cables.

NOTE

The Guard connections shown in Figure 605-2 represent a unique potential within the data logger. Input shields should be connected to the Shield (pin 2), not to the Guards.

TOP

L0	A	1	H0
GUARD	B	2	SHIELD
H1	C	3	L1
–	D	4	GUARD
L2	E	5	H2
GUARD	F	6	–
H3	H	7	L3
–	J	8	A/D COM.
TEMP. SIG.	K	9	6.2V dc (OUT)
BSL	L	10	REF. COM.
GUARD	M	11	–
L4	N	12	H4
–	P	13	GUARD
H5	R	14	L5
GUARD	S	15	–
L6	T	16	H6
–	U	17	GUARD
H7	V	18	L7
GUARD	W	19	–
L8	X	20	H8
–	Y	21	GUARD
H9	Z	22	L9

Lx = Low input to channel x.
Hx = High input to channel x.
Where: x = Block channel No. (0 - 9)
– = Not Used

Figure 605-2. GENERAL PURPOSE SCANNER REAR PANEL PIN ASSIGNMENTS

LOW LEVEL SCANNER - OPTION –06

606-1. INTRODUCTION

606-2. The Low Level Scanner (Option –06) is a programmable relay switch module designed to operate as a plug-in option in any one of the scanner block slots in a 2200 Series Data Logger/Scanner Extender (hereafter referred to collectively as data logger). The –06 scanner contains 11 three-pole, form-A reed relays. Separate contacts on each relay are connected to three separate busses (one pole to each bus) to form a three-pole, 10-channel scanner, complete with treeing relay. The three-pole scanner provides unique switching of high, low and shield inputs for each channel. The treeing relay operates when any one of the channel relays is operated and connects the scanner busses to the input of the A/D converter. When the scanner is idle, the open treeing relay isolates the scanner capacitance from the input of the A/D converter.

606-3. SPECIFICATIONS

606-4. Specifications for the Low Level Scanner are contained in Section 1 of this manual.

606-5. INSTALLATION

606-6. The Low Level Scanner mounts in any one of the available scanner block slots provided in the data logger, as shown in Figure 606-1. Install the scanner as follows:

WARNING!

Remove line power and all other high voltage inputs to the data logger before starting this procedure.

a. Remove the top dust cover from the data logger.

b. Remove the large top-inner cover located in the left rear of the unit (as viewed from the top front).

CAUTION!

Handle the scanner pcb by its edges to avoid contaminating the pcb with oil from the hands. The use of gloves is recommended.

c. Select the slot that includes the block of channels the scanner is to represent, and align the scanner in the slot so that the 44-pin board-edge connector is toward the rear of the unit, and the small offset board-edge connectors are toward the bottom of the unit. Push the scanner straight down onto the mating connectors.

d. After the desired number of scanners are installed, install the large left-rear inner cover.

e. Install the top dust cover.

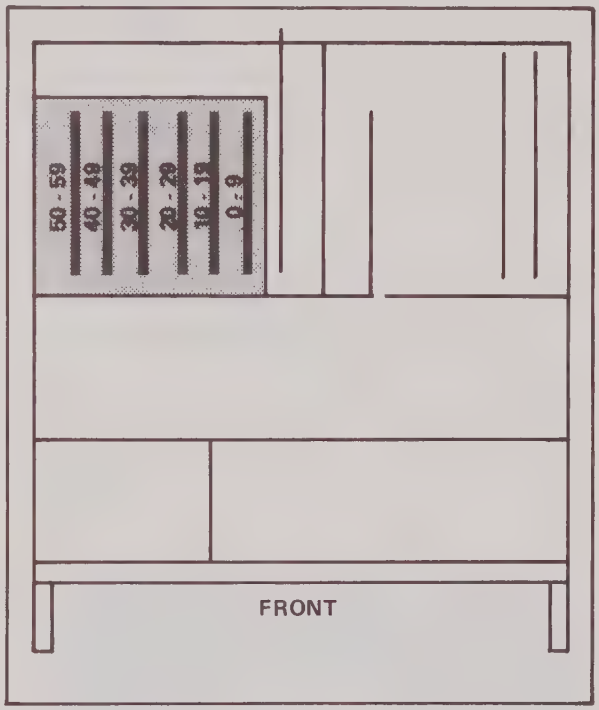


Figure 606-1. SCANNER MOUNTING LOCATIONS

606-7. OPERATION

606-8. Once installed in the data logger, the Low Level Scanner requires no operator attention. However, certain considerations are necessary to properly interface the scanner with remote stimulus data. These considerations are covered in the following paragraphs.

606-9. Input Connections

606-10. Analog interface connections with the Low Level Scanner are completed through either one-of-two types of connectors which attach to the scanner module connectors at the rear of the data logger. The connectors are available as options, and include: The Solder Pin Connector (Option –07) and the Isothermal Block Connector (Option –08). The Solder Pin Connector is a general purpose assembly which consists of a 44-pin connector mounted on a pcb. Solder type cable connections are provided. A clam-shell

housing provides strain relief for the cable, and protection of the connector contacts. The Isothermal Block Connector is required for thermocouple inputs. It features an isothermal block with screw-type connections, and a temperature sensing circuit. The temperature sensing circuit allows the measurement system to compensate for temperature changes that occur on the isothermal block.

606-11. Input Pin Assignments

606-12. The pin assignments for the rear panel connector of the Low Level Scanner are shown in Figure 606-2. Since contact with these signals is completed through one-of-two optional connectors (Option –07 or –08) refer to the appropriate option sub section for pin assignments as available for fabricating interface cables.

NOTE

The Guard connections shown in Figure 606-2 represent a unique potential within the data logger. Input shields should be connected to the Shield pins, not to the Guard pins.

TOP

L0	A	1	H0
GUARD	B	2	S0
H1	C	3	L1
S1	D	4	GUARD
L2	E	5	H2
GUARD	F	6	S2
H3	H	7	L3
S3	J	8	A/D COM.
TEMP. SIG.	K	9	6.2V dc (OUT)
BSL	L	10	REF. COM.
GUARD	M	11	S4
L4	N	12	H4
S5	P	13	GUARD
H5	R	14	L5
GUARD	S	15	S6
L6	T	16	H6
S7	U	17	GUARD
H7	V	18	L7
GUARD	W	19	S8
L8	X	20	H8
S9	Y	21	GUARD
H9	Z	22	L9

Sx = Shield
Lx = Low input to channel x.
Hx = High input to channel x.
Where:x = Block channel no. (0-9)

Figure 606-2. LOW LEVEL SCANNER REAR PANEL PIN ASSIGNMENTS

SOLDER PIN CONNECTOR OPTION –07

607-1. INTRODUCTION

607-2. The Standard Input Connector (Option –07) is a general purpose connector assembly which mounts in the rear of the data logger and provides electrical contact with the analog inputs of either the General Purpose Scanner or the Low Level Scanner Blocks. The connector is designed for use in fabricating a custom interface cable to provide external analog inputs to a single scanner block.

607-3. The connector assembly consists of a 44-pin board-edge connector mounted on a pcb, and a clam-shell enclosure. The enclosure separates from the assembly to provide access to solder-type connections at the rear of the connector. Strain relief for the cable connections is provided by the enclosure.

607-4. SPECIFICATIONS

607-5. Specifications for the Standard Input Connector are contained in Section 1 of this manual.

607-6. CABLE FABRICATION

607-7. Figure 607-1 identifies the connector pins and signals necessary to interface with either the General Purpose Scanner or the Low Level Scanner. Access to the solder-type terminals on the connector is accomplished by removing the four screws from the decal side of the connector enclosure. The decal identifies the pin connections and provides spaces for the user to uniquely identify the connector's block assignment and each of its channel inputs.

607-8. INSTALLATION

607.9. The Solder Pin Connector and cable assembly mount in any one of the available scanner-block slots containing a scanner module. See Figure 607-2. Install the Solder Pin Connector as follows:

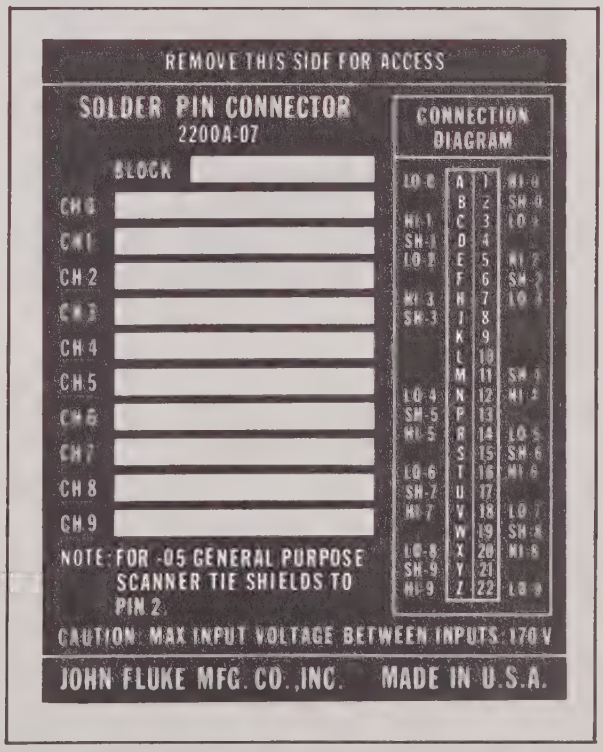


Figure 607-1. SOLDER PIN CONNECTOR PIN ASSIGNMENTS.

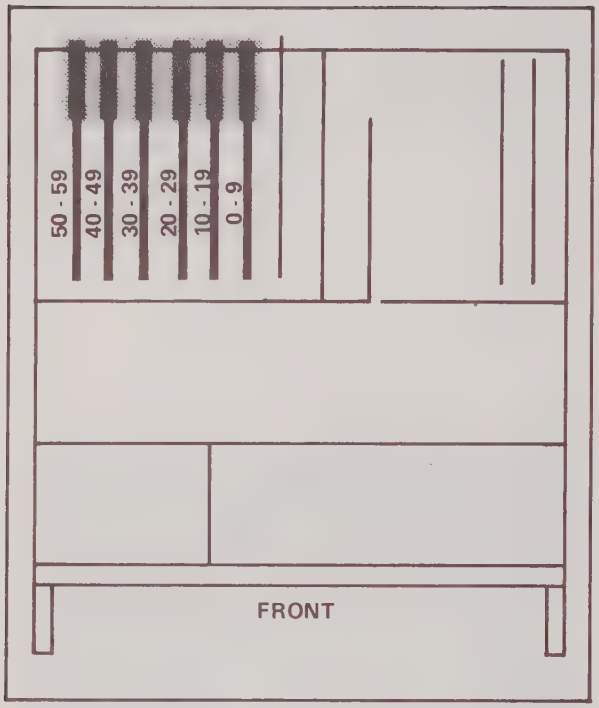


Figure 608-2. ISOTHERMAL BLOCK CONNECTOR MOUNTING LOCATIONS

c. With the connector key toward the top, position the Isothermal Block Connector in the guides of the selected slot and mate it with the scanner's connector.

d. Install the two retaining screws and washers that hold the input connector to the data logger.

e. After the required number of input connectors are installed, install the rear-panel enclosure.

608-10.CALIBRATION

608-11. The reference junction on the Isothermal Block Connector has been calibrated at the factory and does not require periodic calibration to meet the specifications given in Section1. However, calibration is required after the connector undergoes repair, or if the seal on the factory adjustment has been broken. The required equipment is listed in Table 608-1. Use the following procedure to calibrate the reference junction.

a. Calibrate the A/D Converter (Option –09 or –10) as described in the appropriate option subsection.

b. Install a Low Level Scanner (Option –06) in block 0 of the data logger.

Table 608-1. EQUIPMENT REQUIRED FOR CALIBRATION

DESCRIPTION	RECOMMENDED MODEL OR TYPE
Thermocouple Probe	Type J, K, or T (select type compatible with data logger being used)
Low Level Scanner	Fluke –06 Option
Mercury Thermometer, 0.02°C Resolution	Princo ASTM-56C
Dewar Flask and Cap	1-pint Thermos Bottle

c. Connect the thermocouple probe to the Channel 0 (zero) terminals on the Isothermal Block Connector. Leave the terminal side of the connector cover off during the calibration procedure.

d. Attach the Isothermal Block Connector to the scanner in slot 0.

e. Prepare a room-temperature lag bath using the thermos bottle, and insert the thermometer and the thermocouple probe into the bath. (Allow the lag bath at least 15 minutes to stabilize).

f. Energize the data logger and program it as follows:

   a. Set First Channel to 00 (2240A only).
   b. Set Last Channel to 00.
   c. Select temperature function (T1, T2, T3, or T4) that is compatible with the thermocouple probe.
   d. Depress the CONTINUOUS scan control switch.

g. The data logger display should read the temperature of the lag bath as indicated by the mercury thermometer. If the display is in error, slowly adjust the pot on the Isothermal Block Connector while observing the display. The adjustment is correct when the display agrees with the thermometer reading and remains constant for at least 30 seconds.

GENERAL PURPOSE A/D CONVERTER OPTION –09

609-1. INTRODUCTION

609-2. The General Purpose A/D Converter (Option –09) is a general purpose dual-slope integrator. It is a factory installed plug-in option, and includes two voltage ranges (4V and 400 mV). All ranges operate in conjunction with the data logger's front-panel display to provide a five-digit full-scale read-out of 39999. As a result, 10uV can be accurately resolved on the 400 mV range. When the A/D Converter is equipped with the Temperature Measurement Option –11, temperatures of either 1°C or 1°F can be resolved. Function selection is accomplished via the standard front-panel controls included with the data logger. Analog inputs to the A/D Converter are multiplexed through the optional relay scanners installed in the data logger.

609-3. SPECIFICATIONS

609-4. Specifications for the General Purpose A/D Converter are contained in Section 1 of this manual.

609-5. OPERATION

609-6. The General Purpose A/D Converter requires no operator attention other than ensuring that the input voltages present at the measurement channels are compatible with the measurement functions selected for the A/D Converter. Instructions for selecting range and function are contained in Section 2 of this manual.

609-7. MAINTENANCE

609-8. Access/Disassembly

609-9. The A/D Converter is accessed by removing the top dust cover, and the inner guard cover from the data logger. The position of the A/D Converter in the data logger is shown in Figure 609-1. Access to the calibration adjustments does not require the removal of the inner guard cover.

609-10. To remove the A/D Converter from the data logger, remove the inner guard cover and disconnect the rear-panel 2201A cable which attaches to the data logger. (This cable is present only if the data logger is equipped with the Scanner Extender Chassis, Model 2201A). Pull the A/D Converter PCB straight up and out through the top of the data logger.

609-11.Calibration

609-12. The General Purpose A/D Converter should be calibrated when the data logger is calibrated or after major repairs have been made to the pcb. A DC Calibrator and a DVM are required for calibration. The recommended instruments are listed in Section 4, Table 4-1. The calibration adjustments and test points are all located on the A/D Converter PCB, and are shown in Figure 609-1. Use the following procedure to calibrate the A/D Converter:

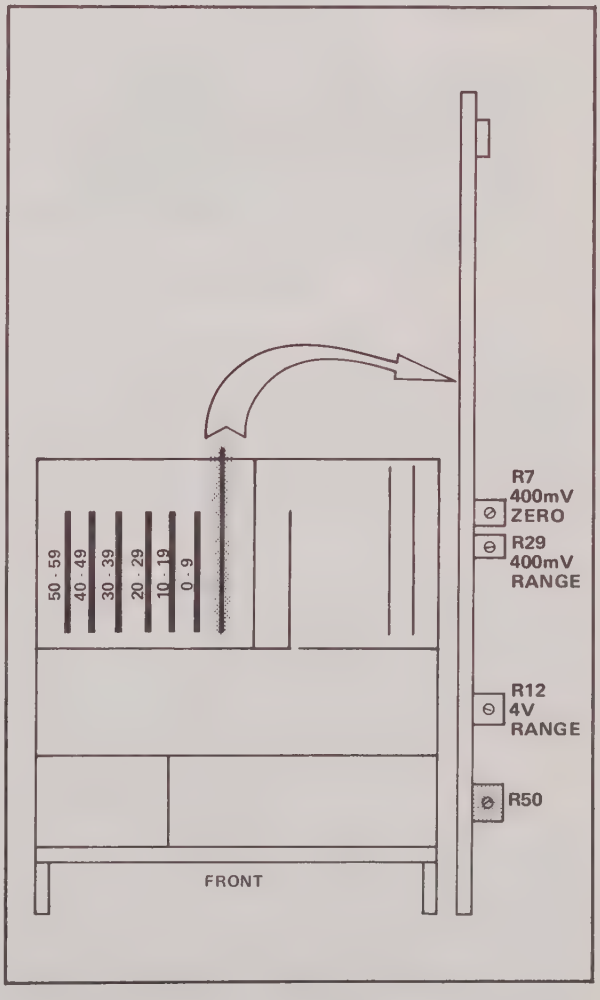


Figure 609-1. GENERAL PURPOSE A/D CONVERTER TEST POINT AND ADJUSTMENT LOCATIONS

a. Energize the data logger and press the STOP/RESET switch in the SCAN CONTROL switch group.

b. Install a Scanner pcb (Option –05 or –06) in scanner slot 0 of the data logger.

c. Set the output of the DC Calibrator to 0V, and, using a Solder Pin Connector (Option –07), connect the output of the DC Calibrator to channel 0 of the scanner in slot 0.

d. Program the data logger to perform the following scan sequence:

1. Monitor Channel 00
2. Function = 400 mV

e. Press the MONITOR switch and adjust the 400 mV ZERO pot (R7) for a zero indication i.e., the display alternates between a + and – polarity indication. Ignore the digital display.

NOTE

Under normal conditions steps f through j may be omitted from the calibration procedure. However, if the A/D Converter has been repaired prior to calibration, component parts have been replaced, or potentiometers R50 has been inadvertently adjusted the steps must be executed.

f. Remove the inner guard cover and mount the A/D Converter on extender cables.

g. Program the data logger for the 4V function and set the DC Calibrator for a +1mV output.

h. Adjust R50 for a display of 0.0010V.

i. Reverse the polarity of the DC Calibrator output. The display should read –0.0010V.

j. Remove the extender cables, mount the A/D Converter in its slot, and install the inner guard cover.

k. Set the output of the DC Calibrator to 3.0000 volts, and adjust R12 for a reading of 3.0000 on the data logger display.

l. Reverse the polarity of the DC Calibrator output. The display should read –3.0000 ± .0002V.

m. Set the DC Calibrator output to +300 mV.

n. Program the data logger function to 400 mV and adjust R29 for a display of 300.00 mV.

HIGH PERFORMANCE A/D CONVERTER OPTION –10

610-1. INTRODUCTION

610-2. The High Performance A/D Converter (Option –10) is a high-resolution multi-range dual-slope integrator. It is a factory installed plug-in option, and includes four standard voltage ranges (40V, 4V, 400 mV, and 40 mV). All ranges operate in conjunction with the front-panel display to provide a five-digit full-scale read-out of 39999. As a result, 1uV can be accurately resolved on the 40 mV range. When the A/D Converter is equipped with the Temperature Measurement Option (–11), temperature of 0.1°C can be resolved. Selection is accomplished via the standard front-panel controls included with the data logger. Analog inputs to the A/D Converter are multiplexed through the optional relay scanners installed in the data logger.

610-3. SPECIFICATIONS

610-4. Specifications for the High Performance A/D Converter are contained in Section 1 of this manual.

610-5. OPERATION

610-6. Once installed in the data logger, the High Performance A/D Converter requires no operator attention other than ensuring that the input voltages present at the measurement channels are compatible with the measurement functions selected for the A/D Converter. Instructions for selecting range and function are contained in Section 2 of this manual.

610-7. The measurement speed of the High Performance A/D Converter can be set by the operator for either 3 (slow) or 15 (fast) readings per second. The selection of measurement speed is accomplished by setting a slide switch on the A/D Converter PCB to the fast or slow position. The access procedure, the switch location, and the switch settings are described later under maintenance.

610-8. MAINTENANCE

610-9. Access/Disassembly

610-10. The A/D Converter is accessed by removing the top dust cover, and the inner guard cover from the data logger. The position of the A/D Converter in the data logger is shown in Figure 610-1. Access to the calibration adjustments does not require the removal of the guard cover. The test points referred to in the Calibration procedure are accessible through the rear panel.

610-11. To remove the A/D Converter from the data logger, remove the inner guard cover and disconnect the rear panel connector from the A/D Converter (this connector is present only if the data logger is equipped with the Scanner Extender Chassis, Model 2201A.) Pull the A/D Converter PCB straight up and out through the top of the data logger.

610-12.System Self-Check

610-13. Two output voltages (+0.02 and +2.0V dc) are available at the rear of the data logger when the High Performance A/D Converter is installed. These voltages can be temporarily attached to a suspect channel to check its operation, or permanently connected to dedicated channels to establish a system-self check feature. The location of the test voltage output connectors (TP1, TP2 and TP3) is shown in Figure 610-1.

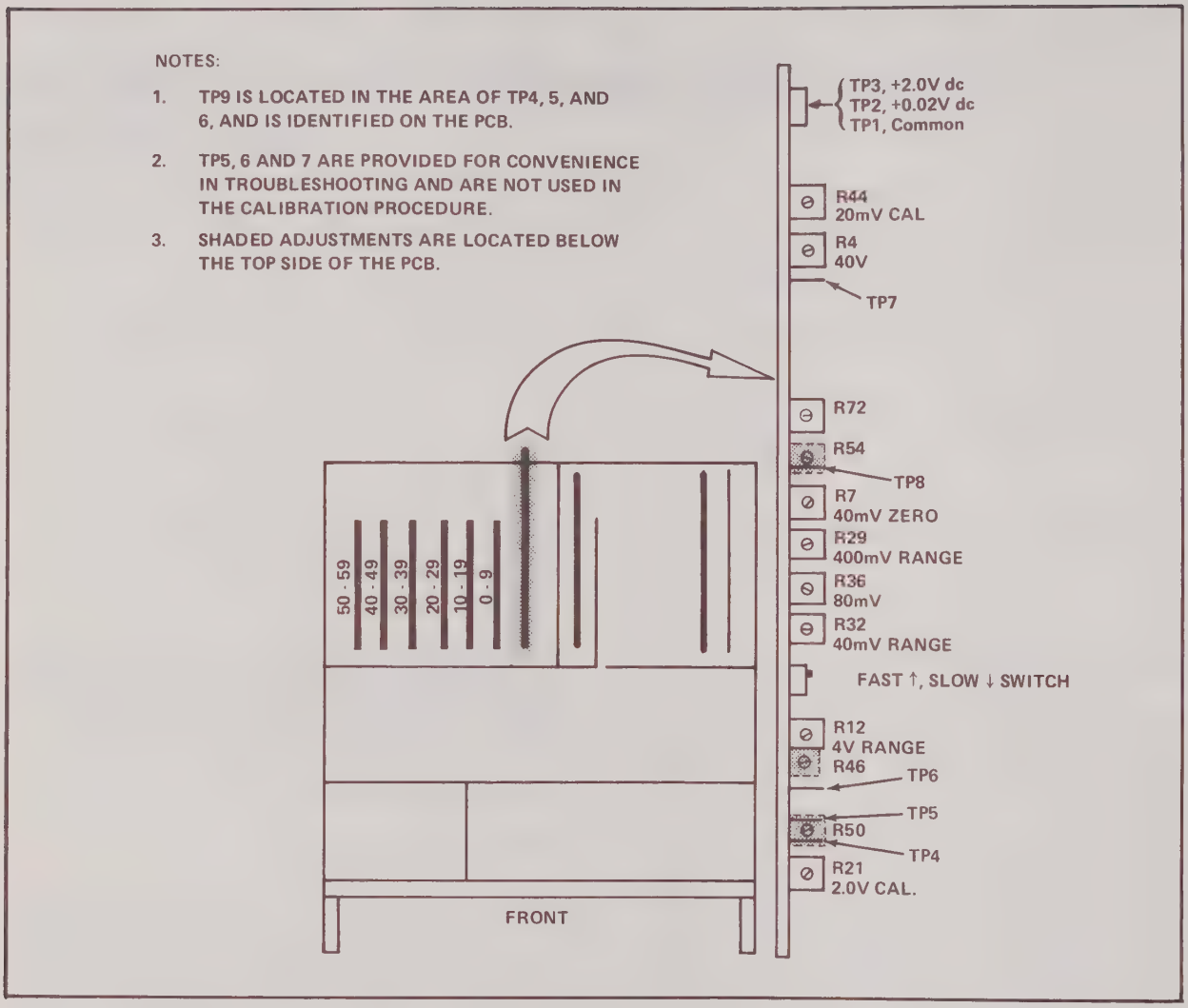


Figure 610-1. HIGH PERFORMANCE A/D CONVERTER TEST POINT AND ADJUSTMENT LOCATIONS

610-14.Calibration

610-15. The High Performance A/D Converter should be calibrated when the data logger is calibratedor after major repairs have been made to the pcb. A DC calibrator and a DVM are required for calibration. The recommended instruments are listed in Section 4, Table 4-1. The calibration adjustments and test points are all located on the A/D Converter PCB, and are shown in Figure 610-1. Use the following procedure to calibrate the High Performance A/D Converter:

a. Energize the data logger and press the STOP/RESET switch in the SCAN CONTROL group.

b. Install a Low Level Scanner (Option –06) in scanner slot 0 of the data logger.

c. Set the output of the DC Calibrator to 0V, and, using a Solder Pin Connector (Option –07), connect the output of the DC Calibrator to Channel 0 of the scanner in slot 0.

d. Program the data logger to perform the following scan sequence:

1. Monitor Channel 00
2. Function = 40 mV

e. Set the Fast/Slow switch on the A/D Converter to Slow. See Figure 610-1.

f. Press the MONITOR switch and adjust the 40 mV ZERO pot (R7) for a zero indication i.e., the display alternates between a + and – polarity indication. Ignore the digital display.

NOTE

Under normal conditions steps g through o may be omitted from the calibration procedure. However, if the A/D Converter has been repaired prior to calibration, component parts have been replaced, or potentiometers R46, R50 or R55 have been inadvertently adjusted the steps must be executed.

g. Remove the inner guard cover and mount the A/D Converter on extender cables.

h. Connect a DVM between tp4 (common) and tp8. Adjust R54 for a reading of 0 ±20 mVdc.

i. Program the data logger for the 4V function and set the DC Calibrator for a +1mV output.

j. Adjust R50 for a data logger display of 0.0010V.

k. Reverse the polarity of the DC Calibrator output. The display should read –0.0010V.

l. Set the Fast/Slow switch to Fast and adjust R46 for a display of –0.0010V.

m. Reverse the polarity of the DC Calibrator output. The display should read 0.0010V.

n. Set the Fast/Slow switch to Slow.

o. Set the output of the DC Calibrator to 0V.

p. Connect the DVM between tp4 and tp9.

q. Adjust R72 for a DVM reading of 0 ±5 mV dc.

r. Remove the extender cables, mount the A/D Converter in its slot, and install the inner guard cover. Allow the A/D Converter 30 minutes to stabilize its temperature before proceeding.

s. Set the output of the DC Calibrator to +3.0000 volts and adjust R12 for a display of 3.0000V.

t. Reverse the polarity of the DC Calibrator output. The reading should be –3.0000 ±.0002V.

u. Set the DC Calibrator output to +300 mV.

v. Program the data logger function to 400 mV and adjust R29 for a display of 300.00 mV.

w. Set the DC Calibrator output to +60 mV.

x. Program the data logger function to 80 mV and adjust R36 for a display of 30000.

NOTE

The 80 mV function is programmed using the HI LIMIT switch on the 2240A, and FUNCTION switch position 9 on the 2200A.

y. Set the DC Calibrator output to +30 mV.

z. Program the data logger function to 40 mV and adjust R32 for a reading of +30.000mV.

aa. Program the data logger to the 40V function and set the DC Calibrator output to 0 volts. The display should read 0.000V.

ab. Set the DC Calibrator output to +30V and adjust R4 for a display of 30.000V.

ac. Connect the DVM betweet tp1 (common) and tp3 on the A/D Converter pcb. Adjust R21 for a DVM display of +2.0000V dc.

ad. Connect a DVM between tp1 and tp2. Adjust R44 for a DVM display of +20.000mV.

ae. Set the DC Calibrator to 0 volts and program the data logger function to 40 mV. The data logger display should read 0.000V.

af. Set the Fast/Slow switch to the speed at which the A/D converter is to operate and adjust R7 for a data logger display of 0.000V.

TEMPERATURE MEASUREMENT SYSTEM OPTION –11

611-1. INTRODUCTION

611-2. The Temperature Measurement System (Option –11) provides the data logger with the capability of converting thermocouple voltages into direct temperature measurements (°C or °F). The option consists of a plug-in Sampling Assembly which mounts on the A/D Converter (Option –09 or –10) and two ROM's (linearization and configuration) which plug into the Controller PCB Assembly. The Sampling Assembly operates in conjunction with the Isothermal Block Connector (Option –08), and periodically samples the compensation voltage produced by the reference junction. This voltage is measured by the A/D Converter and presented to the Control Logic for use later in the temperature conversion cycle. The Linearization ROM contains five linearizing programs for converting the output of a J, K, T, R and S thermocouple into a voltage which is proportional to temperature. The configuration ROM allows any four of the five programs can be uniquely assigned to, and enabled by the front panel FUNCTION switches, T1, T2, T3 and T4. Linearizing programs for other thermocouple types require the use of an additional PROM.

611-3. The voltage presented to the linearizer is equal to the voltage generated by the thermocouple probe, plus the two thermocouple junctions formed by attaching the probe to the Isothermal Block Connector, minus the compensating voltage generated by the reference junction on the Isothermal Block Connector. In other words, the reference junction voltage is used to negate the effect of the thermocouple junction formed at the Isothermal Block Connector so that the linearizer is presented with an input voltage which is representative of the temperature of the thermocouple probe.

611-4. The data logger is capable of utilizing any four of the available linearizer programs. These programs are specified in terms of thermocouple probe types (See specifications in Section 1), and must be defined when the data logger is purchased. However, either a Celsius or a Fahrenheit temperature scale can be selected in the field.

611-5. SPECIFICATIONS

611-6. Specifications for the Temperature Measurement Converter option are contained in Section 1 of this manual.

611-7. INSTALLATION

611-8. The Temperature Measurement Converter must be installed at the factory or any one of the Fluke Technical Service Centers. Once the option is installed, the selected linearizer programs cannot be changed by the user. However, either a Celsius or Fahrenheit temperature scale for temperature functions T1, T2, T3 and T4 is switch selectable. Use the following procedure to set the Celsius/Fahrenheit switch:

a. Remove the top dust cover from the data logger.

b. Remove the Controller PCB Assembly shown in Figure 611-1.

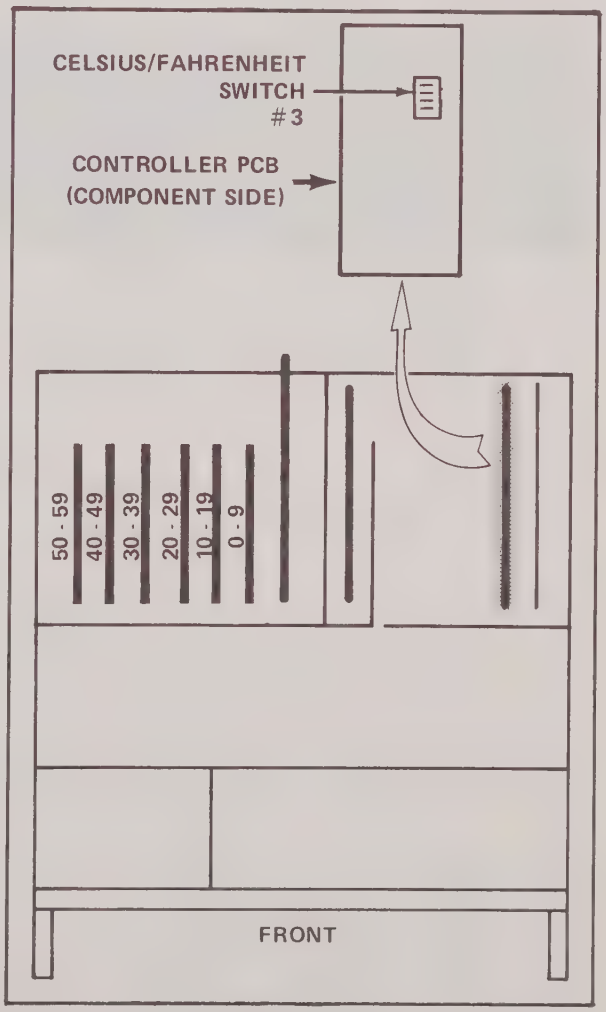


Figure 611-1. CONTROLLER PCB AND CELSIUS/ FAHRNEHEIT SWITCH LOCATIONS

c. Locate the series of four rockers switches on the Controller PCB.

d. Set switch number 3 to OFF for a Celsius temperature scale or ON for a Fahrenheit temperature scale.

611-9. OPERATION

611-10. Once installed in the data logger, the Temperature Measurement System requires no operator attention other than ensuring that the thermocouple probes connected at the measurement channels are compatible with the meausrement functions selected for those channels. Instructions for assigning measurement functions to specific channels are contained in Section 2 of this manual.

NOTE

Thermocouple temperature measurements require the use of an Isothermal Block Connector (Option –08).

NOTE

When a series of C's is displayed during a scan sequence, it indicates that the thermocouple input for the channel indicated is open circuited (R source > 7.5 ±2.5kΩ). See Figure 611-2.

611-11. CALIBRATION

611-12. The Temperature Measurement System requires no calibration. However, its accuracy is dependent upon the calibration of the A/D Converter (Option –09 or –10) and the reference junction on the Isothermal Block Connector (Option –08).

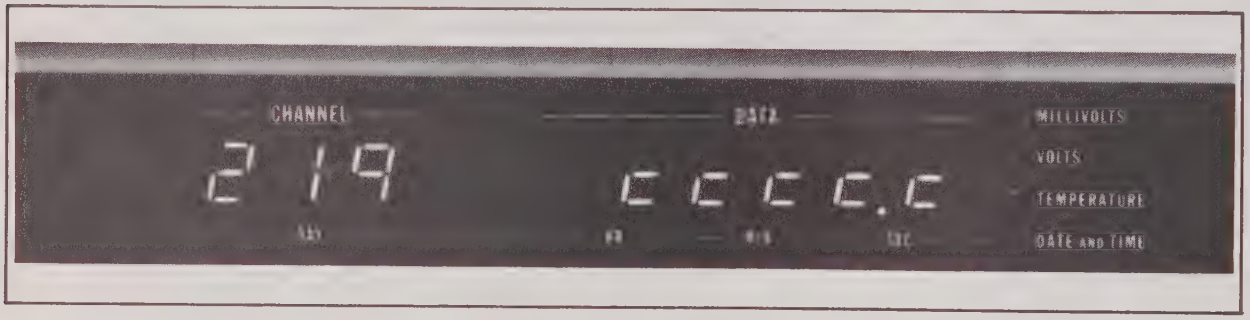


Figure 611-2. OPEN THERMOCOUPLE INDICATION FOR CHANNEL 219

TELEPRINTER INTERFACE OPTIONS —12 SERIES

612-1. SCOPE

612-2. The —12 Series Options include Options —12A through —12J and are described in Section 1 of this manual, Table 1-2. Each option in the series is compatible with a commercially available teleprinter or cassette recorder. The information contained herein deals with the basic Digital Output PCB used to interface these recorders.

612-3. INTRODUCTION

612-4. The Digital Output PCB is designed to transfer bit serial/character-serial data from the data logger to an external recording peripheral. This includes: Time-of-Year (2240A), Fixed Data (2240A), Scan Counter (2200A), Digital Input Data (Option —16), and measurement data. The appropriate carriage-return and line-feed characters are also generated. Provisions are included for initiating a scan sequence using a remote start input.

612-5. A unique interface cable and a series of 24 switches on the pcb are used to tailor the digital output with the recorder. The cable is included as part of the option. The switches are set by the user to define baud rate and data format.

612-6. The Digital Output PCB used with the —12A and —12B Options uses a 20 mA current loop to interface with an ASR33 Teletype. A relay on the pcb opens and closes the loop for character transmission. The 20 mA current source must be resident in the Teletype.

612-7. The Digital Output PCB used with the —12C, —12D, —12E and —12H Options is designed to interface with EIA RS-232-C compatible units. The unique characteristics of each of these options is listed below:

1. The —12C Option includes a Carriage Return Delay for use with TI's "Silent 700" series units. Selectable baud rates are :100, 300. Two stop bits are included for 110 baud; one stop bit for 300 baud.

2. The —12D Option is a General Purpose RS-232-C Interface. Selectable baud rates include: 110, 300, 1200, 2400 and 4800. Two stop bits are included for 110 baud; one stop bit for all others. Data transmission can be controlled using Data Set Ready and Clear to Send signals.

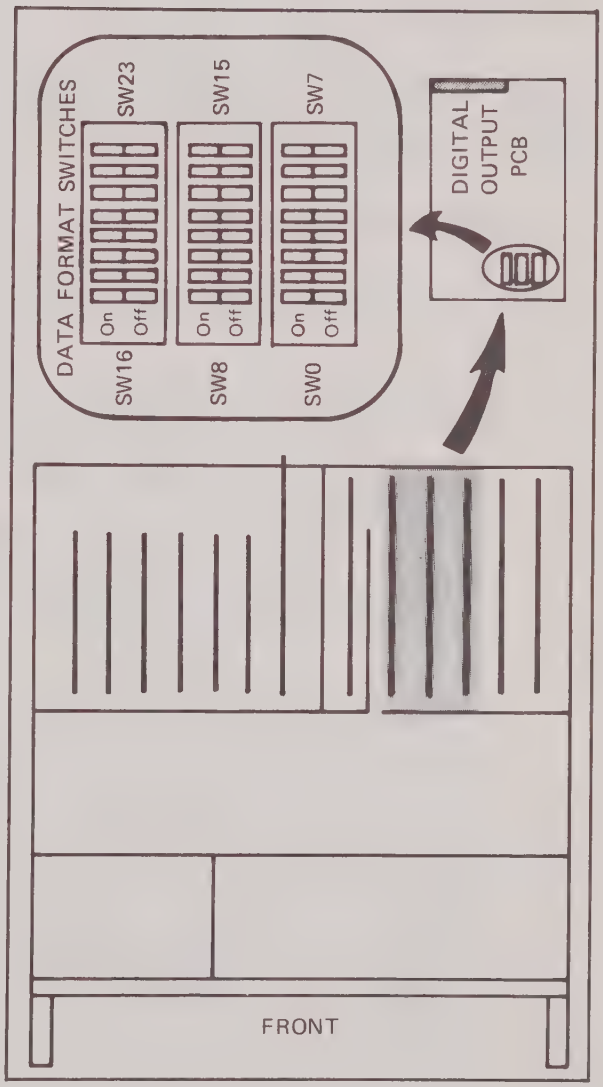


Figure 612-1. DIGITAL OUTPUT PCB, INSTALLATION AND SWITCH LOCATIONS.

3. The —12E and —12H Options are RS-232-C interfaces designed for use with the Techtran Model 8400 and 8410 Datacassette. Selectable baud rates include: 110, 300, 1200 and 2400. Two stop bits are included for 110 baud; one stop bit for all others. Data transmission can be controlled using Data Set Ready and Clear to send signals.

612-8. SPECIFICATIONS

612-9. Specifications for the –12 series of options are contained in Section 1 of this manual.

612-10.INSTALLATION

612-11.Digital Output PCB

612-12. Up to three Digital Output PCB's can be mounted in the data loggers I/O slots, as shown in Figure 612-1. Install each –12 Series pcb as follows:

a. Set the data loggers POWER switch to OFF.

b. Remove the top cover from the data logger.

c. Locate the Data Format switches on each –12 Series Digital Output PCB, as shown in Figure 612-1.

d. With reference to Figure 612-2, establish the format of recorded data as follows:

1. Set switches 0 through 11 to ON. This establishes the format shown in Figure 612-2.

2. Delete any combinations of unwanted character segments by setting the assigned switches to OFF.

3. Set the desired baud rate using switches 16 through 19.

4. If a TTY is used to record data, set switches 12 through 15 to the desired number of readings per line (1 through 16).

NOTE

Set unused switches to OFF.

e. Align each Digital Output PCB in its selected I/O slot so that the large female connector is toward the rear of the data logger, and the small board-edge connector is toward the bottom of the unit. Push the pcb straight down onto the mating connector.

e. After the Digital Output PCB('s) is (are) installed, install the top cover.

612-13.Interface Cable

612-14. The interface cable supplied with the Digital Output PCB is designed to interface a specific recording device (See Table 1-2 in Section 1 of this manual). If data logger scan sequences are to be initiated manually using the front-panel switches, connect the interface cable between the Digital Output PCB's rear-panel connector and the appropriate recorder. If the scan sequences are to be initiated by a remote input, complete the following procedure prior to connecting the interface cable:

a. Remove the hood from the 50-pin connector which mates with the Digital Output PCB.

b. Locate the three coiled wires stowed in the hood.

c. Uncoil the wires and identify each prior to reassembling the connector.

1. Pin 31 - Start
2. Pin 6 - Scan in Progress (SIP)
3. Pin 48 - Logic Common

d. Install the interface cable and connect the remote control lines to the desired source. The function of each line is described below:

1. START - If the REMOTE switch in the data logger's SCAN CONTROL switch group is depressed, a contact closure to Logic Common or a low TTL/DTL logic level will initiate a scan sequence. If a scan is in progress, the Start input is ignored.

2. SIP - TTL output goes low to indicate that a scan is in progress. Start inputs during this period are ignored.

3. LOGIC COMMON - Logic common for the start input and SIP output signals.

NOTE

If a single remote control source is used and more than one Digital Output PCB is installed, it is sufficient to complete the remote control connections on only one interface cable.

612-15.OPERATION

612-16. Once installed in the data logger, the Digital Output PCB requires no operator attention. Instructions for connecting the remote control lines are given under Installation. Refer to the appropriate teleprinter/cassette-recorder instruction manual for additional recorder information.

RECORDED DATA FORMAT

CR LF

START OF SCAN

D D D : H H : M M : S S CR LF

SWO — SW1

TIME OF YEAR (2240A ONLY)

CR LF SP SP FD FD FD FD FD FD CR LF

SW2 — SW3

FIXED DATA (2240A) - SCAN COUNTER (2200A)

AC AC SP DD DD DD DD DD DD DD DD DD CR LF

DIGITAL INPUT DATA (Option –16)

CH	CH	CH	SP	SP	AD	AD	AD	·	AD	AD	SP	F	SP	SP
			> <	±				Floating Decimal Point			m	V C	CR	LF
←SW4→			SW5	SW6	SW7			SW8		SW9	←SW10→		←SW11→	

MEASUREMENT DATA – NORMAL

MEASUREMENT UNITS

CH	CH	CH	SP	SP	SP	O B	L T	SP	SP	SP	m SP	V C F	CR	LF
						OVERLOAD								

BROKEN THERMOCOUPLE — MEASUREMENT UNITS

MEASUREMENT DATA – ABNORMAL

SWITCHES 12 THRU 23

NOT USED				BAUD RATE 1 = ON				READINGS PER LINE = $2^n + 1$			
20	21	22	23	16	17	18	19	12	13	14	15
				110 = 1	1	1	1	2^3	2^2	2^1	2^0
				300 = 1	1	0	1				
				1200 = 1	0	1	1		(TTY ONLY)		
				2400 = 1	0	0	1				
				4800 = 1	1	1	0				

AC	=	Address Code
AD	=	Analog Data
CH	=	Channel Number
CR	=	Carriage Return
D	=	Day Code
DD	=	Digital Input Data
FD	=	Fixed Data
H	=	Hours
LF	=	Line Feed
M	=	Minutes
S	=	Seconds
SP	=	Space

Figure 612-2. RECORDED DATA FORMAT AND DIGITAL OUTPUT PCB SWITCH ASSIGNMENTS

PAPER TAPE PUNCH INTERFACE OPTIONS –13 SERIES

613-1. SCOPE

613-2. The –13 Series Options include Options 13A through 13C, and are described in Section 1 of this manual, Table 1-2. Each option in the series is compatible with the Facit Model 4070 Paper-Tape Punch. The information contained herein deals with the basic Digital Output PCB used to interface the paper-tape punch.

613-3. INTRODUCTION

613-4. The Digital Output PCB is designed to transfer character serial/bit parallel data from the data logger to an external paper-tape punch. This includes: Time-of-Year, Fixed Data (2240A), Scan Counter (2200A), Digital Input Data (Option –16), and measurement data. The appropriate carriage-return and line-feed characters are also generated. Provisions are included for initiating a scan sequence using a remote start input.

613-5. A special interface cable and a series of 24 switches located on the pcb are used to tailor the digital output with the 4070 Paper-Tape Punch. The cable is included as part of the option. The switches are set by the user to define the data format.

613-6. The Digital Output PCB transfers ASCII, 8-level character serial data to the paper tape punch along with a Punch pulse. In response, the paper tape punch returns a Ready signal to the pcb. The Ready signal allows data to be sent as fast as the punch can handle it.

613-7. The eighth bit of each character is an odd parity bit. Provisions are included on the pcb for selecting even parity.

613-8. SPECIFICATIONS

613-9. Specifications for the –13 Series of options are contained in Section 1 of this manual.

613-10.INSTALLATION

613-11.Digital Output PCB

613-12. Up to three Digital Output PCB's can be mounted in the data logger's I/O slots, as shown in Figure 613-1. Install each –13 Series PCB as follows:

a. Set the data loggers POWER switch to OFF.

b. Remove the top cover from the data logger.

c. Locate the Data Format switches on each –13 Series Digital Output PCB, as shown in Figure 613-1.

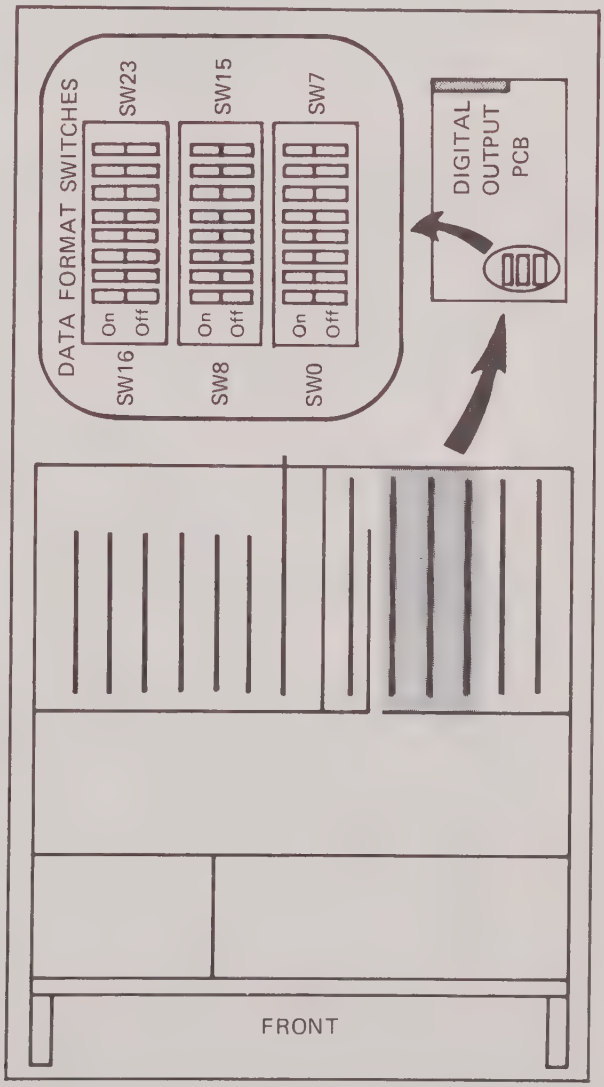


Figure 613-1. DIGITAL OUTPUT PCB, INSTALLATION AND SWITCH LOCATIONS.

RECORDED DATA FORMAT

@ CR LF

START OF SCAN

D D D : H H : M M : S S CR LF

SW0 → SW1

TIME OF YEAR (2240A ONLY)

CR LF SP SP FD FD FD FD FD FD CR LF

SW2 → SW3

FIXED DATA (2240A) - SCAN COUNTER (2200A)

AC AC SP DD DD DD DD DD DD DD DD DD CR LF

DIGITAL INPUT DATA (Option –16)

Floating Decimal Point

CH CH CH SP SP AD AD AD . AD AD SP SP CR LF

(m) (VCF)

SW4 | SW5 | SW6 | SW7 | SW8 | SW9 | SW10 | SW11

MEASUREMENT DATA – NORMAL

MEASUREMENT UNITS

OVERLOAD (OL)

CH CH CH SP SP SP B T SP SP SP SP F CR LF

(m) (VCF)

BROKEN THERMOCOUPLE

MEASUREMENT UNITS

MEASUREMENT DATA – ABNORMAL

SWITCHES 12 THRU 23

NOT USED

READINGS PER LINE = $2^n + 1$

20	21	22	23	16	17	18	19	12	13	14	15
								2^3	2^2	2^1	2^0

AC	=	Address Code
AD	=	Analog Data
CH	=	Channel Number
CR	=	Carriage Return
D	=	Day Code
DD	=	Digital Input Data
FD	=	Fixed Data
H	=	Hours
LF	=	Line Feed
M	=	Minutes
S	=	Seconds
SP	=	Space

Figure 613-2. RECORDED DATA FORMAT AND DATA OUTPUT PCB SWITCH ASSIGNMENTS.

d. With reference to Figure 613-2, establish the format of recorded data as follows:

1. Set switches 0 through 11 to ON. This establishes the format shown in Figure 613-2.

2. Delete any combination of unwanted character segments by setting the appropriate switches to OFF.

3. Set switches12 through 15 to the desired number of readings per line (1 through 16). When the tape is read by a teleprinter it is necessary to have the number of readings per line defined.

4. Set all unused switches (16 through 23) to OFF.

e. If even parity is required, install a jumper wire as shown in Figure 613-3.

f. Align the Digital Output PCB in the selected I/O slot so that the large female connector is toward the rear of the data logger, and the small board-edge connector is toward the bottom of the unit. Push the pcb straight down onto the mating connector.

g. After the Digital Output PCB ('s) is (are) installed, install the top cover.

613-13. Interface Cable

613-14. The interface cable supplied with the –13 Series Options is designed to connect the Digital Output PCB to the Model 4070 Paper-Tape Punch. If the data logger scan sequences are to be manually initiated using the front-panel switches, connect the interface cable between the Digital Output PCB's rear-panel connector and the paper-tape punch. If the scan sequences are to be initiated by a remote Start input, complete the following procedure prior to connecting the interface cable:

a. Remove the hood from the 50-pin connector which mates with the Digital Output PCB.

b. Locate the three coiled wires stowed in the hood.

c. Uncoil the wires and identify each prior to reassembling the connector.

1. Pin 31 - Start
2. Pin 6 - Scan in Progress (SIP)
3. Pin 48 - Logic Common

d. Install the interface cable and connect the remote control lines to the desired control source. The function of each line is described below:

1. START - If the REMOTE switch in the data logger's SCAN CONTROL switch group is depressed, a contact closure to Logic Common or a low TTL/DTL logic level will initiate a scan sequence. If a scan is in progress, the Start input is ignored.

2. SIP - A TTL output that goes low to indicate that a scan is in progress. Start inputs during this period are ignored.

3. LOGIC COMMON - Logic common for the Start input and the SIP output signals.

NOTE

If a single remote control source is used and more than one Digital Output PCB is installed, it is sufficient to complete the remote control connections on only one interface cable.

613-15. OPERATION

613-16. Once installed in the data logger, the Digital Output PCB requires no operator attention. Instructions for connecting the remote control lines are given under Installation. Refer to the Facit Model 4070 Instruction manual for details concerning the paper tape punch.

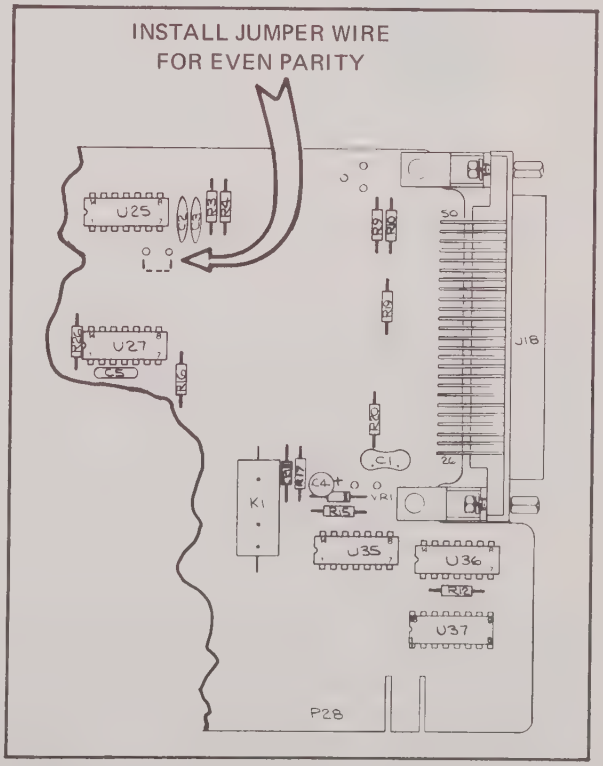


Figure 613-3. EVEN PARITY JUMPER LOCATION, –13 SERIES OPTIONS.

MAGNETIC TAPE INTERFACE OPTIONS –14 SERIES

614-1. SCOPE

614-2. The –14 Series Options include Options –14A through –14G, and are described in Section 1 of this manual, Table 1-2. With the exception of –14F (Custom Magnetic Tape Interface), each option in the series is compatible with one of the Kennedy 1600 Series Magnetic Tape Recorders. The information contained herein deals with the basic Digital Output PCB used to interface these recorders.

614-3. INTRODUCTION

614-4. The Digital Output PCB is designed to transfer character-serial/bit-parallel data from the data logger to an external Kennedy 1600 Series Magnetic Tape Recorder. This includes: Time-of-Year (2240A), Fixed Data (2240A), Scan Counter (2200A), Digital Input Data (Option –16), and measurement data. The appropriate carriage-return and line-feed characters are also generated. Provisions are included for initiating a scan sequence using a remote Start input.

614-5. A unique interface cable and a series of 24 switches on the pcb are used to tailor the digital output with the recorder. The cable is included as part of the option. The switches are set by the user to define baud rate and data format.

614-6. The Digital Output PCB transfers ASCII, 6-level (BCDIC)/7-level (EBCDIC) characters to the recorder along with a write pulse. The character format for each –14 Option is shown in Table 614-1. Odd or even parity can be selected by positioning a jumper wire on the pcb. The pcb is shipped from the factory with the odd parity jumper installed.

Table 614-1. CHARACTER FORMAT OF –14 OPTIONS

OPTION	KENNEDY RECORDER	NO. OF TRACKS	*ASCII CODE
14A	1600/5	7	6 level
14B	1610/5	7	6 level
14C	1600/360	9	7 level
14D	1610/360	9	7 level
14E	1600/5, 1610/5	7	6 level
14G	1600/360, 1610/360	9	7 level

* 6 level = BCDIC
7 level = EBCDIC

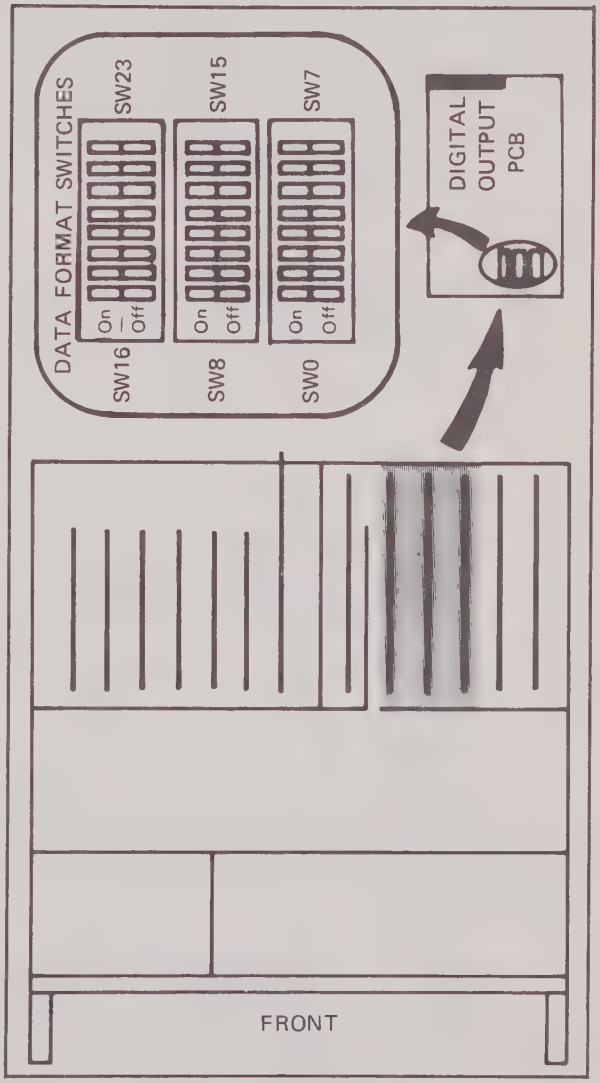
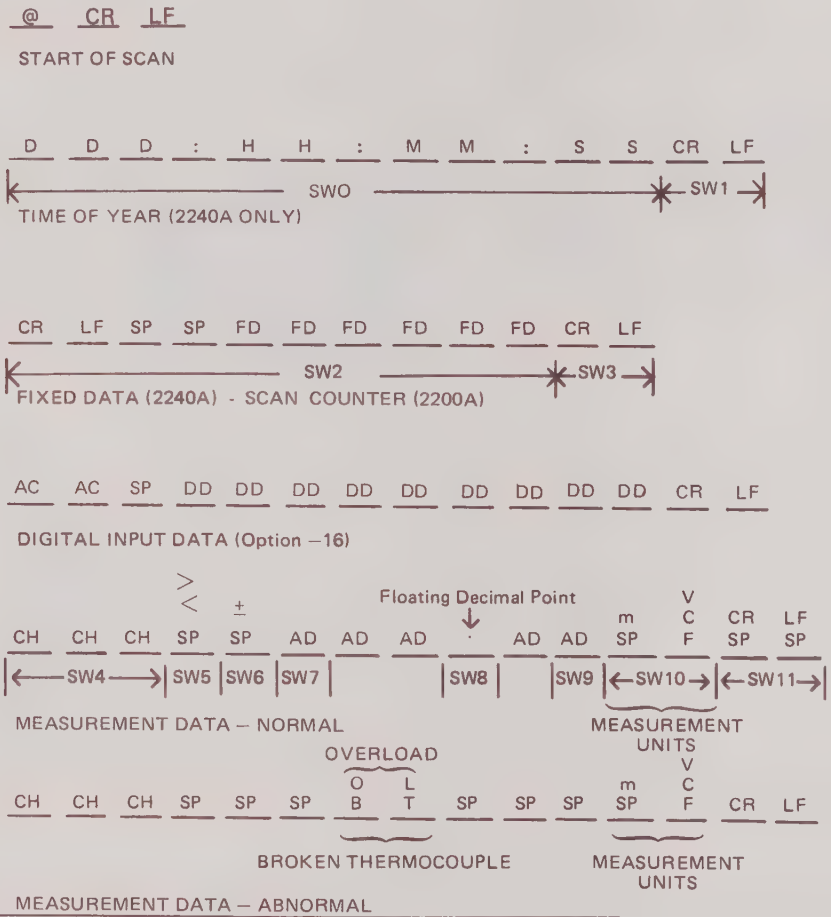


Figure 614-1. DIGITAL OUTPUT PCB, INSTALLATION AND SWITCH LOCATIONS.

614-7. After a preset number of characters (switch selectable) have been transferred to the recorder, the Digital Output PCB generates an Inter-Record Gap (IRG) command. The recorder responds by generating a standard IRG and returning a Gap-In-Progress signal to inhibit a data transfer during the IRG generation. If the scan mode is terminated before the specified number of characters have been transferred, the Digital Output PCB will insert a $ character into the record until the character count is satisfied.

RECORDED DATA FORMAT


@ CR LF
START OF SCAN
D D D : H H : M M : S S CR LF
SW0
SW1
TIME OF YEAR (2240A ONLY)
CR LF SP SP FD FD FD FD FD FD CR LF
SW2
SW3
FIXED DATA (2240A) - SCAN COUNTER (2200A)
AC AC SP DD DD DD DD DD DD DD DD DD CR LF
DIGITAL INPUT DATA (Option –16)
> < ±
Floating Decimal Point
m V
CH CH CH SP SP AD AD AD · AD AD SP C CR LF
F SP SP
SW4 SW5 SW6 SW7 SW8 SW9 SW10 SW11
MEASUREMENT DATA – NORMAL
MEASUREMENT UNITS
OVERLOAD
O L
m V
CH CH CH SP SP SP B T SP SP SP SP C CR LF
F
BROKEN THERMOCOUPLE
MEASUREMENT UNITS
MEASUREMENT DATA – ABNORMAL

SWITCHES 12 THRU 23

CHARACTERS PER RECORD

20	21	22	23	16	17	18	19	12	13	14	15
2^{11}	2^{10}	2^{9}	2^{8}	2^{7}	2^{6}	2^{5}	2^{4}	2^{3}	2^{2}	2^{1}	2^{0}

Set switches to indicate maximum number of recorded characters per scan sequence, $2^{n}+1$. 1 = ON, 0 = OFF

AC	=	Address Code
AD	=	Analog Data
CH	=	Channel Number
CR	=	Carriage Return
D	=	Day Code
DD	=	Digital Input Data
FD	=	Fixed Data
H	=	Hours
LF	=	Line Feed
M	=	Minutes
S	=	Seconds
SP	=	Space

Figure 614-2. RECORDED DATA FORMAT AND DIGITAL OUTPUT PCB SWITCH ASSIGNMENTS.

614-8. SPECIFICATIONS

614-9. Specifications for the –14 Series of options are contained in Section 1 of this manual.

614-10.INSTALLATION

614-11.Digital Output PCB

614-12. Up to three Digital Output PCB's can be mounted in the data logger's I/O slots, as shown in Figure 614-1. Install each –14 Series pcb as follows:

a. Set the data loggers POWER switch to OFF.

b. Remove the top cover from the data logger.

c. Locate the Data Format switches on each –14 Series Digital Output PCB, as shown in Figure 614-1.

d. With reference to Figure 614-2, establish the format of recorded data as follows:

1. Set switches 0 through 11 to ON. This establishes the format shown in Figure 614-2.

2. Delete any combination of unwanted character segments by setting the appropriate switches to OFF.

3. Set switches 12 through 23 to indicate (in binary) the maximum number of characters to be recorded during a scan sequence. One to 4096 characters can be selected (1 = ON, 0 = OFF).

e. Refer to Figure 614-3 and check to ensure that the parity jumper is properly positioned. If necessary, reposition the jumper to obtain the desired odd or even parity.

f. Align the Digital Output PCB in the selected I/O slot so that the large female connector is toward the rear of the data logger, and the small board-edge connector is toward the bottom of the unit. Push the pcb straight down onto the mating connector.

g. After the Digital Output PCB ('s) is (are) installed, install the top cover.

614-13.Interface Cable

614-14. The interface cable supplied with the –14 Series Options is designed to connect the Digital Output PCB to the appropriate Kennedy 1600 Series Magnetic Tape Recorder. If the data logger scan sequences are to be manually initiated using the front-panel switches, connect the interface cable between the Digital Output PCB's rear-panel connector and the tape recorder. If the scan sequence is to be initiated by a remote input, complete the following procedure prior to connecting the interface cable:

a. Remove the hood from the 50-pin connector that mates with the Digital Output PCB.

b. Locate the three coiled wires stowed in the hood.

c. Uncoil the wires and identify each prior to reassembling the connector.

1. Pin 31 - Start
2. Pin 6 - Scan in Progress (SIP)
3. Pin 48 - Logic Common

d. Install the interface cable and connect the remote control lines to the desired control source. The function of each line is described below:

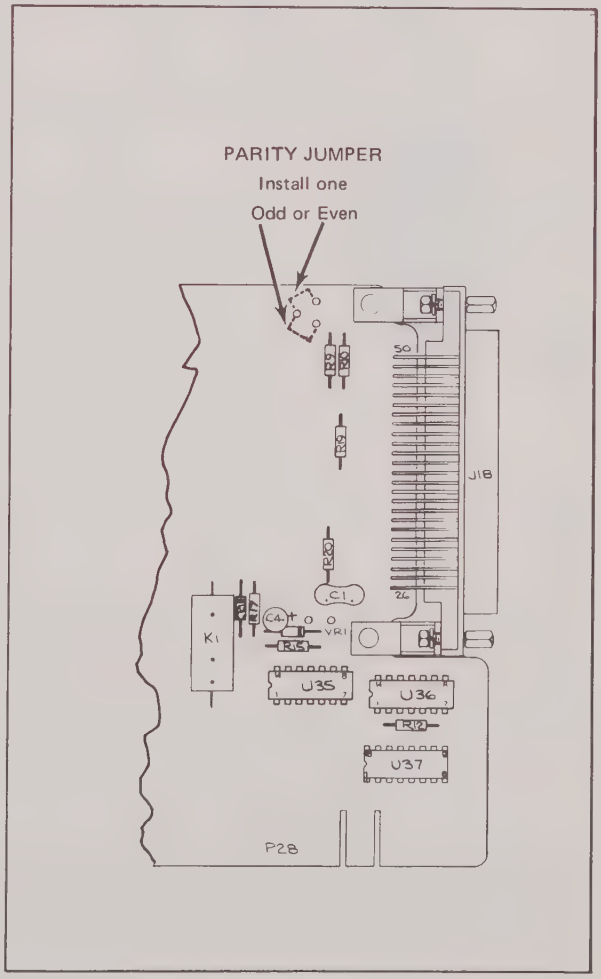


Figure 614-3. PARITY JUMPER LOCATION, –14SERIES OPTIONS.

1. START - If the REMOTE switch in the data logger's SCAN CONTROL switch group is depressed, a contact closure to Logic Common or a low TTL/DTL logic level will initiate a scan sequence. If a scan is in progress, the Start input is ignored.

2. SIP - A TTL output that goes low to indicate that a scan is in progress. Start inputs during this period are ignored.

3. LOGIC COMMON - Logic common for the Start input and the SIP output signals.

NOTE

If a single remote control source is used and more than one Digital Output PCB is installed, it is sufficient to complete the remote control connections on only one interface cable.

614-15.OPERATION

614-16. Once installed in the data logger, the Digital Output PCB requires no operator attention. Instructions for connecting the remote control lines are given under installation. Refer to the appropriate Kennedy 1600 Series Instruction Manual for details concerning the magnetic tape recorder.

DIGITAL INPUT OPTION –16

616-1. INTRODUCTION

616-2. The Digital Input Option (–16) is a plug-in pcb assembly designed to provide the printer and external recording devices with up to nine digits of Digital Input Data. The data is derived from a remote source in BCD character parallel format (DTL/TTL, positive-true) and loaded into storage by a remote Load Data pulse. Data cannot be loaded while the recorders are reading input data, and Busy/$\overline{\text{Busy}}$ output flags are provided to indicate the read period. The read period occurs immediately prior to the first analog data reading.

616-3. The data logger is capable of accommodating up to three Digital Input Option PCB's. The digital data from the pcb's are read in a sequence determined by the setting of four Address Code Switches located on each pcb. The user assigns the addresses so that the first pcb to be read is coded as address 0, the second is coded 1, and the third is coded 2. The order in which the pcb's are installed in the data logger does not influence the order in which data is read.

616-4. SPECIFICATIONS

616-5. Specifications for the Digital Input Option (–16) are contained in Section 1 of this manual.

616-6. INSTALLATION

616-7. Up to three Data Input Option PCB's can be mounted in the data loggers I/O slots, as shown in Figure 616-1. Install each pcb as follows:

a. Set the data logger's POWER switch to OFF.

b. Remove the top cover from the data logger.

c. Locate the Address Code Switches on each Data Input PCB as shown in Figure 616-1, and assign consecutive address codes (starting with 0) to each pcb by setting the switches to the patterns shown in Table 616-1. When Digital Input Data is recorded, address 0 is read first, 1 second, and 2 last.

d. Align each Data Input PCB in its selected I/O slot so that the large female connector is toward the rear of the data logger, and the small board-edge connector is toward the bottom of the unit. Push the pcb straight down onto the mating connector.

e. After the Digital Input pcb (s) is (are) installed, install the top cover.

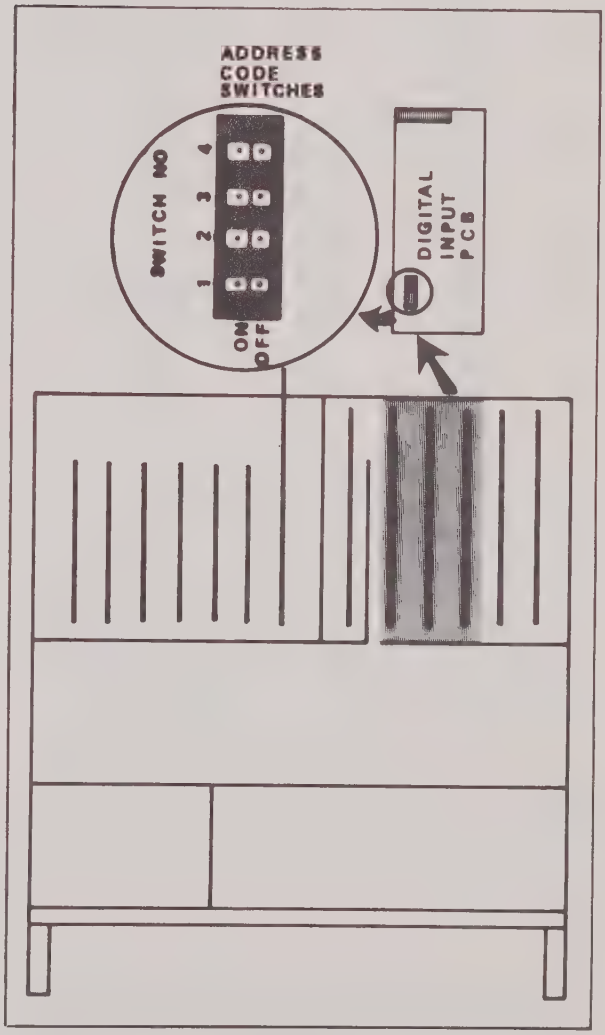


Figure 616-1. DATA INPUT OPTION, INSTALLATION AND SWITCH LOCATIONS.

Table 616-1. ADDRESS CODE SWITCH PATTERNS

ADDRESS CODE	ADDRESS CODE SWITCH SETTINGS			
	1	2	3	4
0	ON	ON	ON	ON
1	ON	ON	ON	OFF
2	ON	ON	OFF	ON

Table 616-2. OPTION –16, I/O CONNECTOR (J33) PIN ASSIGNMENTS

PIN	SIGNAL		PIN	SIGNAL	
1	N/C		26	$\overline{\text{LOAD}}$	
2	DB0	DIGIT 4	27	DB3	DIGIT9 (LSD)
3	DB1		28	DB2	
4	DB2		29	DB1	
5	DB3		30	DB0	
6	$\overline{\text{BUSY}}$		31	SIGNAL GND.	
7	BUSY		32	SIGNAL GND.	
8	DB3	DIGIT 3	33	DB0	DIGIT8
9	DB2		34	DB1	
10	DB1		35	DB2	
11	DB0		36	DB3	
12	N/C		37	+5V dc	OUTPUT
13	N/C		38	+5V dc	
14	DB3	DIGIT 2	39	DB0	DIGIT7
15	DB2		40	DB1	
16	DB1		41	DB2	
17	DB0		42	DB3	
18	N/C		43	DB0	DIGIT6
19	N/C		44	DB1	
20	DB3	DIGIT 1 (MSD)	45	DB2	
21	DB2		46	DB3	
22	DB1		47	DB3	DIGIT5
23	DB0		48	DB2	
24	N/C		49	DB1	
25	N/C		50	DB0	

N/C = No Connection

616-8. OPERATION

616-9. Once installed in the data logger, the Digital Input Option requires no operator attention. However, certain considerations are necessary to properly interface the option with remote input data. These considerations are covered in the following paragraphs.

616-10. Interface Connections

616-11. Remote interface connections to a Data Input PCB are completed through a General Purpose Interface Cable (2200A-7006) or a blank Interface Connector (2200A-7007) which attaches to the Data Input PCB connector at the rear of the data logger. The cable and connector are both available as accessories and are described earlier in this section of the manual.

Table 616-3. I/O DATA REQUIREMENTS

Logic Levels . . .	DTL/TTL compatible, positive true.
Input Data Format .	Up to nine BCD, character-parallel digits.
$\overline{\text{Load}}$ Pulse	Input Data is loaded by a negative going pulse at the $\overline{\text{Load}}$ input. The pulse duration must be $\leq$ 50us.
Busy/$\overline{\text{Busy}}$	Input data can be loaded any time the Busy pulse is low or the $\overline{\text{Busy}}$ pulse is high.
Unused Digits . . .	The inputs for unused digits may be left open. Data will not be recorded in these positions.
+5V dc Output . .	A +5V dc output is available to power external circuitry. The total current drain should not exceed 50 mA.

616-12. The user is responsible for completing the cable connections to the remote data source. The pin assignments for the Digital Input Options rear-panel connector are given in Table 616-2.

616-13. I/O Data Requirements

616-14. The I/O requirements necessary to load data into a Digital Input Option PCB are given in Table 616-3. See Table 616-2 for I/O connector pin assignments.

PROGRAM MEMORY EXPANSION OPTION –20

620-1. INTRODUCTION

620-2. The Program Memory Expansion Option (–20) increases the 2240's program memory from 128 individual channels to either 256 individual channels or 170 individual channels and 83 blocks of 10 channels. A switch inside the 2240A allows the user to select either the Individual or Block Mode. In the Individual Mode a total of 256 channels can be programmed. A total of 1000 channels can be programmed in the Block Mode.

620-3. INSTALLATION

620-4. The basic 2240A includes the circuitry and controls necessary to accommodate the Program Memory Expansion Option. The option must be installed at the factory or any one of the Fluke Technical Service Centers.

620-5. OPERATION

620-6. Front panel operation of the Program Memory Expansion Option is covered in Section 2 of this manual. Instructions for selecting either the Block Mode or the Individual Mode are given in Figure 620-1.

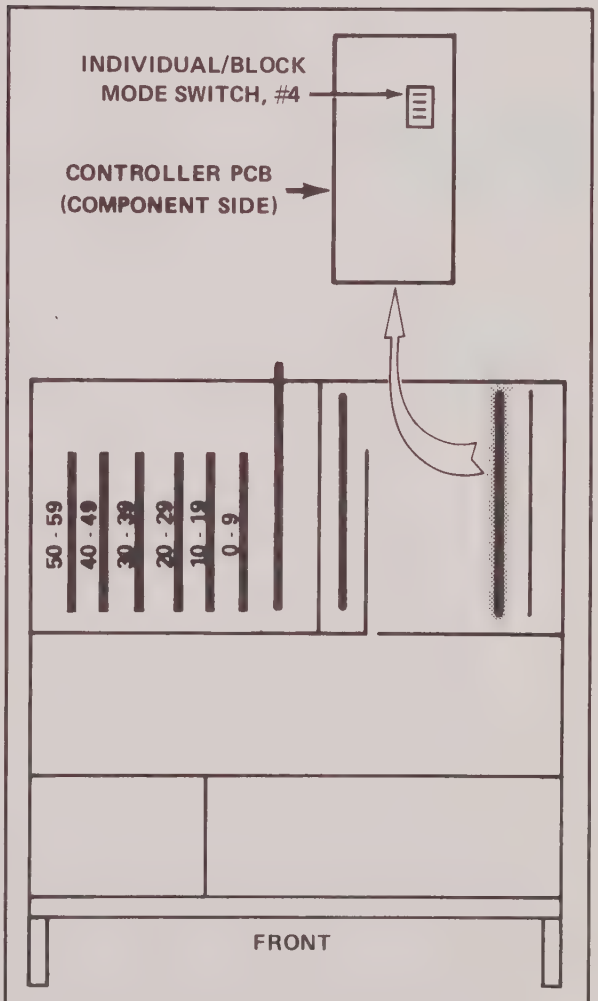

INDIVIDUAL/BLOCK MODE SWITCH, #4
CONTROLLER PCB (COMPONENT SIDE)
50 - 59
40 - 49
30 - 39
20 - 29
10 - 19
0 - 9
FRONT
a. REMOVE TOP DUST COVER FROM DATA LOGGER.
b. REMOVE CONTROLLER PCB.
c. SET SWITCH #4 ON CONTROLLER PCB TO ON FOR THE INDIVIDUAL MODE OR TO OFF FOR THE BLOCK MODE.

Figure 620-1. SWITCH SELECTION OF INDIVIDUAL OR BLOCK MODE.

ALARM SET – SEVEN SINGLE LIMITS OPTION –21

621-1. INTRODUCTION

621-2. The Alarm Set-Seven Single Limits Option (–21) provides the 2240A Data Logger with the capability of establishing seven unique limit values that can be assigned to any available channel. Any limit value can be assigned via front panel controls to any number of channels. However, only one of the seven limit values can be assigned to a single channel. When it is desirable to have two limits for each channel, a second Alarm Set Option must be installed.

621-3. The seven limit values provided by the Alarm Set Option are individually addressable using a two-digit limit address code. LIMIT A address codes (01 through 07) are assigned to the first set of seven limits, and LIMIT B address codes (16 through 22) are assigned to the second set of seven limits. During a channel programming sequence, the operator is able to address, and thereby assign any one limit value from each group to the addressed channel. The actual limit value assigned to a given limit address is determined by the operator during a limits programming sequence. Each of the limits is enabled by entering its address. The limit value is then assigned by defining it as a high or low limit and entering up to four digits plus polarity. The programmed value must fall within the range of +39990 to –39990. The least-significant digit cannot be programmed and is therefore always 0 (zero).

621-4. SPECIFICATIONS

621-5. Specifications for the Alarm Set-Seven Single Limits Option (–21) are contained in Section 1 of this manual.

621-5. INSTALLATION

621-7. The basic 2240A includes the circuitry and front-panel controls and indicators necessary to accommodate the installation of two Alarm Set Options. The option must be installed at the factory or any one of the Fluke Technical Service Centers.

621-8. OPERATION

621-9. Once installed in the data logger, the Alarm Set Options require no operator attention. Instructions for programming the limits for the front panel of the 2240A are contained in Section 2 of this manual.

ALARM SET – FIFTEEN SINGLE LIMITS OPTION –22

622-1. INTRODUCTION

622-2. The Alarm Set–Fifteen Single Limits Option (–22) provides the 2240A with the memory for 15 unique single limit values and 256 limit addresses (256 individual addresses or 170 individual and 83 block addresses. See Option –20 for selection of Individual or Block Mode). Any limit value can be assigned, via the front panel controls, to any available channels and/or blocks depending upon the selected mode. However, only one of the limits can be assigned to a given channel or block. When it is necessary to have two limits for each channel or block, a second Alarm Set Option must be installed.

622-3. The 15 limit values provided by the Alarm Set Option are individually addressable using a two-digit limit address code. LIMIT A address codes (01 through 15) are assigned to the first set of 15 limits, and LIMIT B address codes (16 through 30) are assigned to the second set of limits. During a channel programming sequence, the operator is able to address, and thereby assign any one limit value from each group to the addressed channel/block. The actual limit value assigned to a given address is determined by the operator during a limits programming sequence. Each of the limits is enabled by entering its address. The limit value is then assigned by defining it as high or low and entering up to four digits plus polarity. The programmed value must fall within the range of +39990 to –39990. The least-significant digit cannot be programmed and is therefore always 0 (zero).

622-4. SPECIFICATIONS

622-5. Specifications for the Alarm Set-Fifteen Single Limits Option (–22) are contained in Section 1 of this manual.

622-6 INSTALLATION

622-7. The basic 2240A includes the circuitry and front panel controls necessary to accommodate the installation of two Alarm Set Options. The option must be installed at the factory or any one of the Fluke Technical Service Centers.

622-8. OPERATION

622-9. Once installed in the data logger, the Alarm Set Options require no operator attention. Instructions for programming the limits from the front panel of the 2240A are contained in Section 2 of this manual.

ALARM SET POINT OUTPUT OPTION –23

623-1. INTRODUCTION

623-2. The Alarm Set-Point Output (Option –23) is a plug-in pcb assembly designed to provide an external output when a measurement at any channel exceeds its assigned limit (s). The output is in the form of thirty separate open-collector transistors. Each collector is identified by a number (1 thru 30) which corresponds to one of the limit addresses. When an output transistor is turned on, it indicates that the limit value of the corresponding limit address has been assigned to the previously measured channel, and that the measurement exceeded the limit value. Memory included on the pcb maintains all limit-exceeded indications until reset. Both manual and remote resets are provided. The manual RESET switch is located above the 2240A's Power Switch. A LIMIT–EXCEEDED lamp located next to the RESET switch, flashes when one or more limit values have been exceeded.

623-3. The open-collector outputs can be used separately to drive multiple external indicators, or wire OR'ed in any combination to drive one-of-two reed relays located on the Alarm Set Point Output PCB. Each reed relay provides an externally accessable, isolated contact closure when operated. Circuitry is provided on the pcb for the installation of two additional reed relays.

623-4. SPECIFICATIONS

623-5. Specifications for the Alarm Set-Point Output (Option –23) are contained in Section 1 of this manual.

623-6. INSTALLATION

623-7. The Alarm Set-Point Output PCB can be mounted in any one of the 2240A's I/O slots, as shown in Figure 623-1. Install the pcb as follows:

a. Set the data logger's power switch to OFF.

b. Remove the top cover from the data logger.

c. Refer to Alarm Relays in paragraph 623-17 and ensure that the proper jumpers are installed.

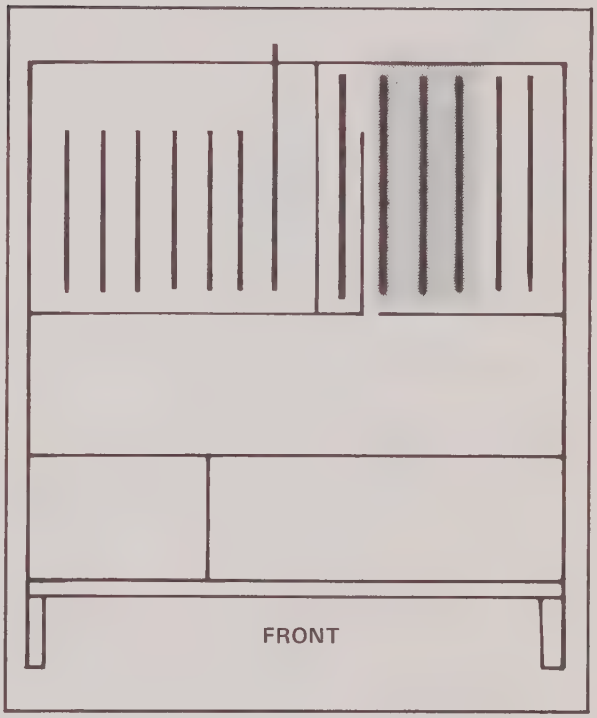


Figure 623-1. ALARM SET-POINT OUTPUT, INSTALLATION LOCATIONS

d. Align the Alarm Set Point Output PCB in the selected I/O slot so that the large female connector is toward the rear of the data logger, and the small board-edge connector is toward the bottom of the unit. Push the pcb straight down onto the mating connector.

e. After the pcb is installed, install the top cover.

623-8. OPERATION

623-9. Once installed in the 2240A, the Alarm Set-Point Output requires no operator attention. However, certain considerations are necessary to properly access and utilize the alarm outputs. These considerations are covered in the following paragraphs.

623-10. Interface Connections

623-11. Remote connections to the Alarm Set-Point Output PCB are completed through either a General Purpose Interface Cable (2200A-7006) or a blank Interface Connector, (2200A-7007). Either the cable or connector attaches to the Alarm Set-Point Output PCB connector at the rear of the data logger. Both the cable and connector are available as accessories and are described earlier in this section.

623-12. The user is responsible for completing the cable connections to the remote input device. The pin connections for the Alarm Set-Point Output's rear-panel connector are given in Table 623-1.

623-13. Alarm Outputs

623-14. The alarm outputs are driven by thirty separate open-collector transistors. When a channel measurement exceeds the limit-vlaue of its assigned limit address (0 thru 30), the corresponding transistor turns-on and pulls the appropriate Alarm Output to logic common. The output is held low until it is either manually or externally reset. Each open-collector output is capable of sinking a maximum of 30 mA when turned on. The maximum VCE, when off, is +25V dc. Power dissipation is 180 mW, maximum.

Table 623-1. OPTION –23, I/O CONNECTOR PIN ASSIGNMENTS

PIN	SIGNAL	PIN	SIGNAL
1	15	26	30
2	14	27	29
3	13	28	28
4	12	29	27
5	11	30	26
6	10	31	25
7	9	32	24
8	ALARMS 8	33	ALARMS 23
9	7	34	22
10	6	35	21
11	5	36	20
12	4	37	19
13	3	38	18
14	2	39	17
15	1	40	16
16	Logic Common (Ungaurded)	41	Logic Common (Unguarded)
17	N/C	42	N/C
18	External Reset	43	N/C
19	Relay 4 (Spare for Contact)	44	Relay 4 (Spare for Contact)
20	N/C	45	
21	Relay 3 (Spare for Contact)	46	Relay 3 (Spare for Contact)
22	N/C	47	N/C
23	Relay 2 (Contact)	48	Relay 2 (Contact)
24	N/C	49	N/C
25	Relay 1 (Contact)	50	Relay 1 (Contact)

623-15. External Reset

623-16. The External Reset input responds to a low input supplied by a contact closure to logic common, or a low, TTL logic level. The reset command must be equal to or exceed 2 μs. A continuously low reset input holds all thirty alarm transistors off regardless of the inputs from the data logger. When the reset is returned high, the alarm transistors are again allowed to respond to alarm data. This function allows a simple control loop to be established using the alarm output as a command and the reset as a response to clear the command. The next scan of the 2240A will then determine if the command needs to be sent again.

623-16. Alarm Relays

623-17. Two alarm relays, K1 and K2 are provided on the Alarm Set Point Output PCB. Normally, the relays are uncommitted. However, they can be assigned by the user to operate with any combination of alarm outputs. The assignments are made by installing a series of jumpers in the spaces provided on the pcb. Figure 623-2 defines the jumper locations. The square land patterns are numbered 1 through 30 and are common to the individual open collector outputs, (1 through 30). The round land patterns are common to the K1 and K2 control busses.

623-19. When jumper wires are installed, the collectors are tied to the relay busses in a wired OR configuration. See Figure 623-3 A. Therefore, when either relay is operated, all alarm outputs common to the relay bus go low. If it is desireable to maintain the integrity of the individual alarm outputs while operating the control relays, install diodes in place of the jumper wires. See Figure 623-3 B.

623-20. Circuitry is included on the Alarm Set-Point Output PCB for the addition of two form-A, reed relays, (K3 and K4) and their associated suppression diodes (CR3 and CR4). The I/O pin assignments for the K3 and K4 contacts are given in Table 623-1. The details necessary to install both relays are shown in Figure 623-4. The relay coils, reed switches and suppression diodes are available from the John Fluke Mfg. Co., Inc. Use the following part numbers when ordering:

a. Relay Coil 288357

b. Reed Switch 413294

c. Suppression Diode . . 203323

623-21. Alarm Output Interface

623-22. The open-collector Alarm Outputs can be used to drive TTL and CMOS logic, LED's or relays. The recommended interface for each of these devices is shown in Figure 623-5.

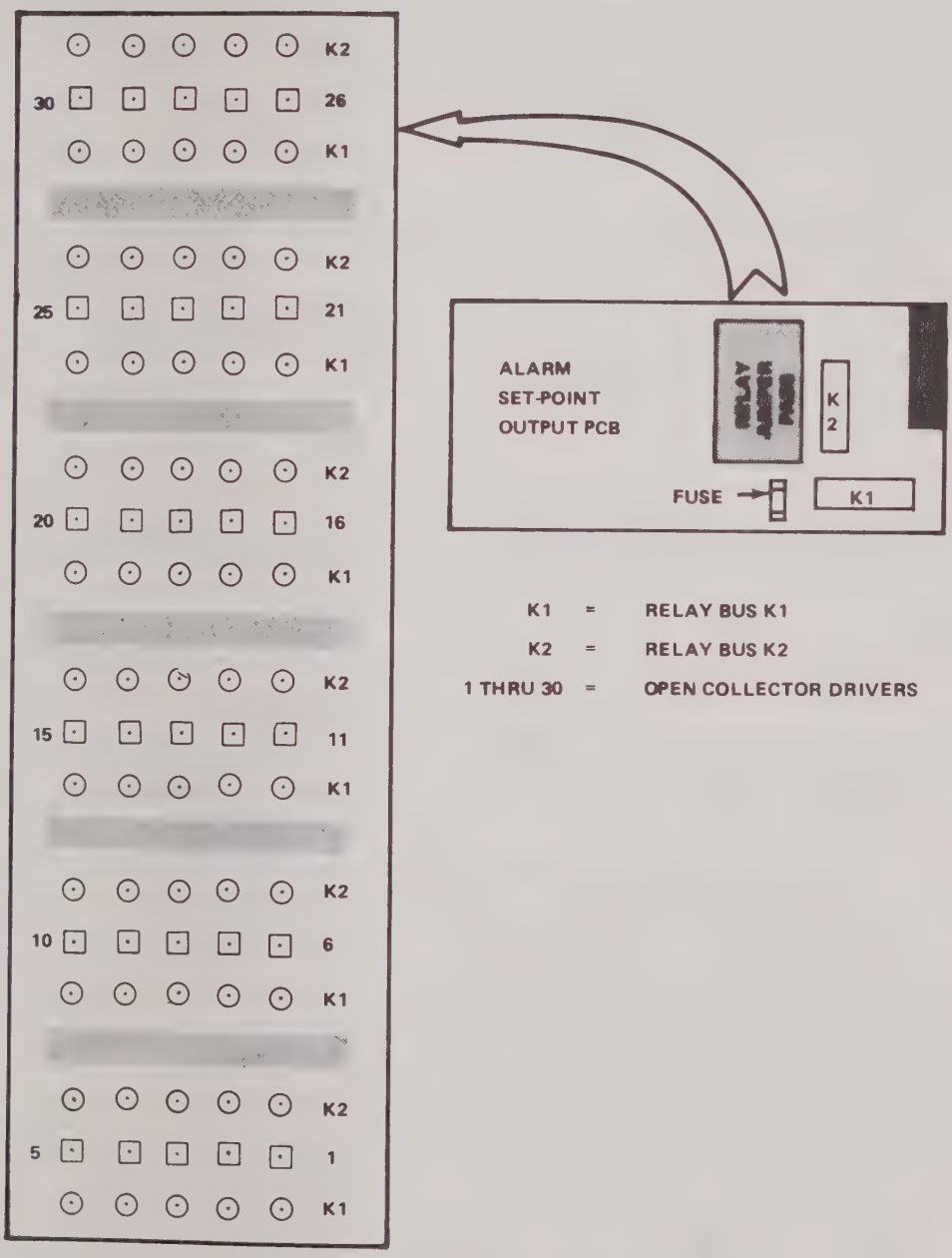


Figure 623-2. ALARM SET-POINT OUTPUT PCB, COLLECTOR-TO-RELAY-BUS JUMPER LOCATIONS.

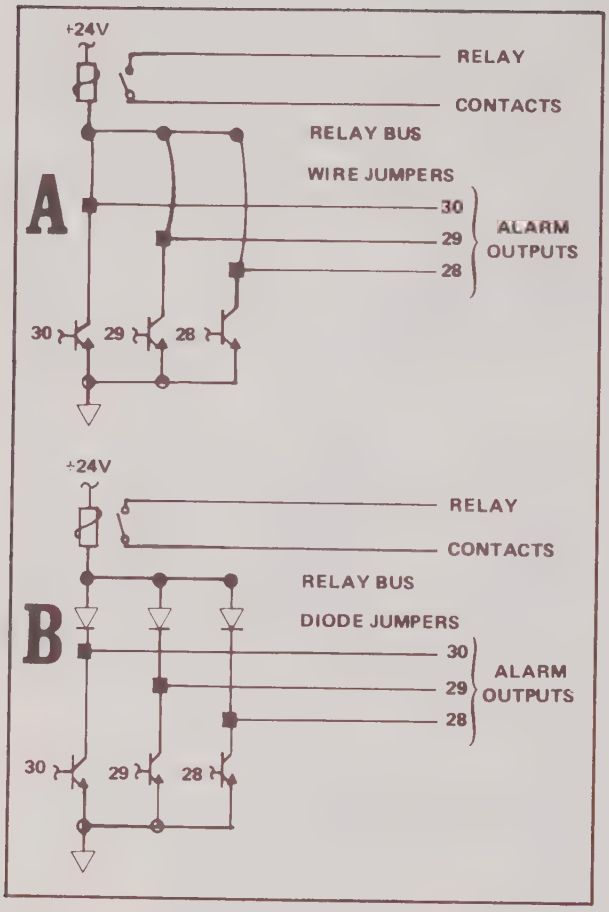


Figure 623-3. COLLECTOR-TO-RELAY-BUS JUMPER CONFIGURATIONS

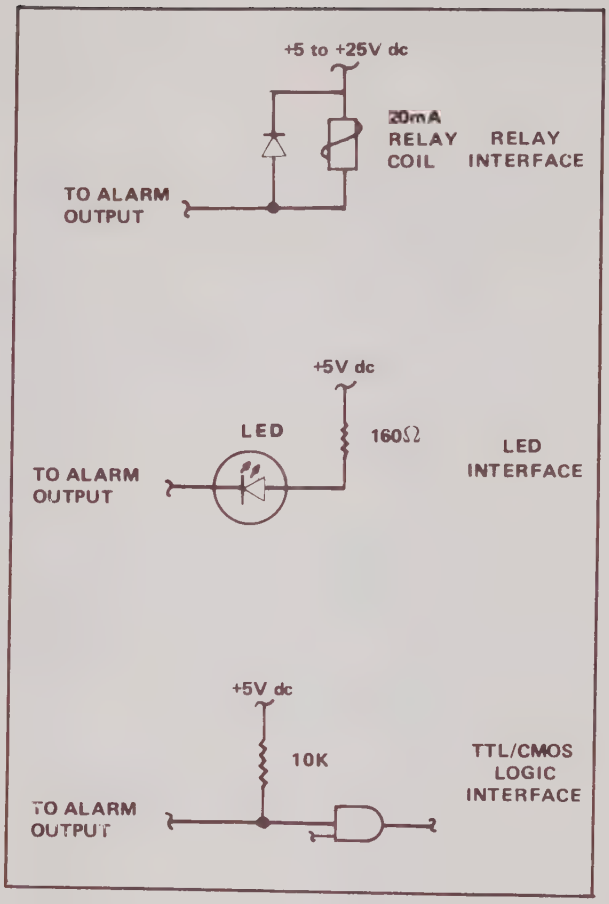


Figure 623-5. RECOMMENDED OUTPUT ALARM INTERFACES.

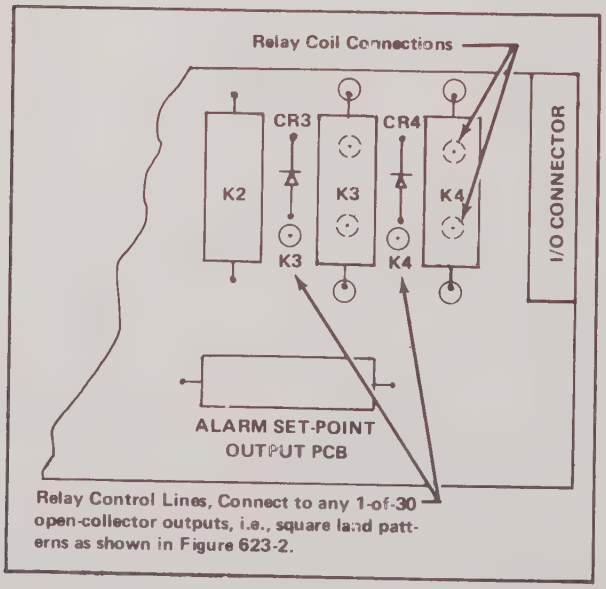


Figure 623-4. LOCATIONS FOR MOUNTING REED RELAYS K3 AND K4

Section 7
General Information

7-1. This section of the manual contains generalized user information as well as supplemental information to the Lists of Replaceable parts contained in Section 5. The following information is presented in this section:

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Table 7-1. LIST OF ABBREVIATIONS AND SYMBOLS

A or amp	ampere
ac	alternating current
af	audio frequency
a/d	analog-to-digital
assy	assembly
AWG	american wire gauge
B	bel
bcd	binary coded decimal
^{o}C	Celsius
cap	capacitor
ccw	counterclockwise
cer	ceramic
cermet	ceramic to metal(seal)
ckt	circuit
cm	centimeter
cmrr	common mode rejection ratio
comp	composition
cont	continue
crt	cathode-ray tube
cw	clockwise
d/a	digital-to-analog
dac	digital-to-analog converter
dB	decibel
dc	direct current
dmm	digital multimeter
dvm	digital voltmeter
elect	electrolytic
ext	external
F	farad
^{o}F	Fahrenheit
FET	Field-effect transistor
ff	flip-flop
freq	frequency
FSN	federal stock number
g	gram
G	giga (10^{9})
gd	guard
Ge	germanium
GHz	gigahertz
gmv	guaranteed minimum value
gnd	ground
H	henry
hd	heavy duty
hf	high frequency
Hz	hertz
IC	integrated circuit
if	intermediate frequency
in	inch(es)
intl	internal
I/O	input/output
k	kilo (10^{3})
kHz	kilohertz
kΩ	kilohm(s)
kV	kilovolt(s)
lf	low frequency
LED	light-emitting diode
LSB	least significant bit
LSD	least significant digit
M	mega (10^{6})
m	milli (10^{-3})
mA	milliampere(s)
max	maximum
mf	metal film
MHz	megahertz
min	minimum
mm	millimeter
ms	millisecond
MSB	most significant bit
MSD	most significant digit
MTBF	mean time between failures
MTTR	mean time to repair
mV	millivolt(s)
mv	multivibrator
MΩ	megohm(s)
n	nano (10^{-9})
na	not applicable
NC	normally closed
(–) or neg	negative
NO	normally open
ns	nanosecond
opnl ampl	operational amplifier
p	pico (10^{-12})
para	paragraph
pcb	printed circuit board
pF	picofarad
pn	part number
(+) or pos	positive
pot	potentiometer
p-p	peak-to-peak
ppm	parts per million
PROM	programmable read-only memory
psi	pound-force per square inch
RAM	random-access memory
rf	radio frequency
rms	root mean square
ROM	read-only memory
s or sec	second (time)
scope	oscilloscope
SH	shield
Si	silicon
serno	serial number
sr	shift register
Ta	tantalum
tb	terminal board
tc	temperature coefficient or temperature compensating
tcxo	temperature compensated crystal oscillator
tp	test point
u or μ	micro (10^{-6})
uhf	ultra high frequency
us or μs	microsecond(s) (10^{-6})
uut	unit under test
V	volt
v	voltage
var	variable
vco	voltage controlled oscillator
vhf	very high frequency
vlf	very low frequency
W	watt(s)
ww	wire wound
xfmr	transformer
xstr	transistor
xtal	crystal
xtlo	crystal oscillator
Ω	ohm(s)
μ	micro (10^{-6})

Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS

00213
Nytronics Comp. Group Inc.
Subsidiary of Nytronics Inc.
Formerly Sage Electronics
Rochester, New York

00327
Welwyn International, Inc.
Westlake, Ohio

00656
Aerovox Corp.
New Bedford, Massachusetts

00686
Film Capacitors, Inc.
Passaic, New Jersey

00779
AMP Inc.
Harrisberg, Pennsylvania

01121
Allen-Bradley Co.
Milwaukee, Wisconsin

01281
TRW Electronic Comp.
Semiconductor Operations
Lawndale, California

01295
Texas Instruments, Inc.
Semiconductor Group
Dallas, Texas

01537
Motorola Communications &
Electronics Inc.
Franklin Park, Illinois

01686
RCL Electronics Inc.
Manchester, New Hampshire

01730
Replaced by 73586

01884 - use 56289
Sprague Electric Co.
Dearborn Electronic Div.
Lockwood, Florida

02114
Ferroxcube Corp.
Saugerties, New York

02131
General Instrument Corp.
Harris ASW Div.
Westwood, Maine

02395
Rason Mfg. Co.
Brooklyn, New York

02533
Snelgrove, C.R. Co., Ltd.
Don Mills, Ontario, Canada
M3B 1M2

02606
Fenwal Labs
Div. of Travenal Labs.
Morton Grove, Illinois

02660
Bunker Ramo Corp., Conn Div.
Formerly Amphenol-Borg
Electric Corp.
Broadview, Illinois

02799
Areo Capacitors, Inc.
Chatsworth, California

03508
General Electric Co.
Semiconductor Products
Syracuse, New York

03614
Replaced by 71400

03651
Replaced by 44655

03797
Eldema Div.
Genisco Technology Corp.
Compton, California

03877
Transistron Electronic Corp.
Wakefield, Massachusetts

03888
KDI Pyrofilm Corp.
Whippany, New Jersey

03911
Clairex Electronics Div.
Clairex Corp.
Mt. Vernon, New York

03980
Muirhead Inc.
Mountainside, New Jersey

04009
Arrow Hart Inc.
Hartford, Connecticut

04062
Replaced by 72136

04202
Replaced by 81312

04217
Essex International Inc.
Wire & Cable Div.
Anaheim, California

04221
Aemco, Div. of
Midtex Inc.
Mankato, Minnesota

04222
AVX Ceramics Div.
AVX Corp.
Myrtle Beach, Florida

04423
Telonic Industries
Laguna Beach, California

04645
Replaced by 75376

04713
Motorola Inc. Semiconductor
Products
Phoenix, Arizona

04946
Standard Wire & Cable
Los Angeles, California

05082
Replaced by 94988

05236
Jonathan Mfg. Co.
Fullerton, California

05245
Components Corp. now
Corcom, Inc.
Chicago, Illinois

05277
Westinghouse Electric Corp.
Semiconductor Div.
Youngwood, Pennsylvania

05278
Replaced by 43543

05279
Southwest Machine &
Plastic Co.
Glendora, California

05397
Union Carbide Corp.
Materials Systems Div.
New York, New York

05571 - use 56289
Sprague Electric Co.
Pacific Div.
Los Angeles, California

05574
Viking Industries
Chatsworth, California

05704
Replaced by 16258

05820
Wakefield Engineering Inc.
Wakefield, Massachusetts

06001
General Electric Co.
Electronic Capacitor &
Battery Products Dept.
Columbia, South Carolina

06136
Replaced by 63743

06383
Panduit Corp.
Tinley Park, Illinois

06473
Bunker Ramo Corp.
Amphenol SAMS Div.
Chatsworth, California

06555
Beede Electrical Instrument Co.
Penacook, New Hampshire

06739
Electron Corp.
Littleton, Colorado

06743
Clevite Corp.
Cleveland, Ohio

06751
Components, Inc. Semcor Div.
Phoenix, Arizona

06860
Gould Automotive Div.
City of Industry, California

06961
Vernitron Corp., Piezo
Electric Div.
Formerly Clevite Corp., Piezo
Electric Div.
Bedford, Ohio

06980
Eimac Div.
Varian Associates
San Carlos, California

07047
Ross Milton, Co., The
South Hampton, Pennsylvania

07115
Replaced by 14674

07138
Westinghouse Electric Corp.,
Electronic Tube Division
Horsehead, New York

07233
TRW Electronic Components
Cinch Graphic
City of Industry, California

07256
Silicon Transistor Corp.
Div. of BBF Group Inc.
Chelmsford, MA

07261
Aumet Corp.
Culver City, California

07263
Fairchild Semiconductor
Div. of Fairchild Camera
& Instrument Corp.
Mountain View, California

07344
Bircher Co., Inc.
Rochester, New York

07597
Burndy Corp.
Tape/Cable Div.
Rochester, New York

07792
Lerma Engineering Corp.
Northampton, Massachusetts

07910
Teledyne Semiconductor
Formerly Continental Device
Hawthorne, California

07933 - use 49956
Raytheon Co.
Semiconductor Div. HQ
Mountain View, California

08225
Industro Transistor Corp.
Long Island City, New York

08261
Spectra Strip Corp.
Garden Grove, California

08530
Reliance Mica Corp.
Brooklyn, New York

08806
General Electric Co.
Miniature Lamp Products Dept.
Cleveland, Ohio

08863
Nylomatic Corp.
Norrisville, Pennsylvania

08988 - use 53085
Skottie Electronics Inc.
Archbald, Pennsylvania

09214
G.E. Co. Semi-Conductor
Products Dept.
Power Semi-Conductor
Products OPN Sec.
Auburn, New York

09353
C and K Components
Watertown, Massachusetts

09423
Scientific Components, Inc.
Santa Barbara, California

09922
Burndy Corp.
Norwalk, Connecticut

09969
Dale Electronics Inc.
Yankton, S. Dakota

10059
Barker Engineering Corp.
Formerly Amerace, Amerace
ESNA Corp.
Kenilworth, New Jersey

11236
CTS of Berne
Berne, Indiana

11237
CTS Keene Inc.
Paso Robles, California

11358
CBS Electronic Div.
Columbia Broadcasting System
Newburyport, MN

11403
Best Products Co.
Chicago, Illinois

11503
Keystone Columbia Inc.
Warren, Michigan

11532
Teledyne Relays
Hawthorne, California

Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS (Continued)

11711
General Instrument Corp
Rectifier Division
Hickville, New York

11726
Qualidyne Corp.
Santa Clara, California

12014
Chicago Rivet & Machine Co.
Bellwood, Illinois

12040
National Semiconductor Corp.
Danburry, Connecticut

12060
Diodes, Inc.
Chatsworth, California

12136
Philadelphia Handle Co.
Camden, New Jersey

12300
Potter-Brumfield Division
AMF Canada LTD.
Guelph, Onatrio, Canada

12323
Presin Co., Inc.
Shelton, Connecticut

12327
Freeway Corp. formerly
Freeway Washer & Stamping Co.
Cleveland, Ohio

12443
Budd Co. The, Polychem Products
Plastic Products Div.
Bridgeport, PA

12615
U.S. Terminals Inc.
Cincinnati, Ohio

12617
Hamlin Inc.
Lake Mills, Wisconsin

12697
Clarostat Mfg. Co.
Dover, New Hampshire

12749
James Electronics
Chicago, Illinois

12856
Micrometals
Sierra Madre, California

12954
Dickson Electronics Corp.
Scottsdale, Arizona

12969
Unitrode Corp.
Watertown, Massachusetts

13103
Thermalloy Co., Inc.
Dallas, Texas

13327
Solitron Devices Inc.
Tappan, New York

13511
Amphenol Cadre Div.
Bunker-Ramo Corp.
Los Gatos, California

13606 - use 56289
Sprague Electric Co.
Transistor Div.
Concord, New Hampshire

13839
Replaced by 23732

14099
Semtech Corp.
Newbury Park, California

14140
Edison Electronic Div.
Mc Gray-Edison Co.
Manchester, New Hampshire

14193
Cal-R-Inc. formerly
California Resistor, Corp.
Santa Monica, California

14298
American Components, Inc.
an Insilco Co.
Conshohocken, Pennsylvania

14655
Cornell-Dublier Electronics
Division of Federal Pacific
Electric Co. Govt. Control Dept.
Newark, New Jersey

14752
Electro Cube Inc.
San Gabriel, California

14869
Replaced by 96853

14936
General Instrument Corp.
Semi Conductor Products Group
Hicksville, New York

15636
Elec-Trol Inc.
Saugus, California

15801
Fenwal Electronics Inc.
Div. of Kidde Walter and Co., Inc.
Framingham, Massachusetts

15818
Teledyne Semiconductors, formerly
Amelco Semiconductor
Mountain View, California

15849
Litton Systems Inc. Useco Div.
formerly Useco Inc.
Van Nuys, California

15898
International Business
Machines Corp.
Essex Junction, Vermont

15909
Replaced by 14140

16258
Space-Lok Inc.
Burbank, California

16299
Corning Glass
Electronic Components Div.
Raleigh, North Carolina

16332
Replaced by 28478

16473
Cambridge Scientific Ind.
Div. of Chemed Corporation
Cambridge, Maryland

16742
Paramount Plastics Fabricators, Inc.
Downey, California

16758
Delco Electronics
Div. of General Motors Corp.
Kokomo, Indiana

17001
Replaced by 71468

17069
Circuit Structures Lab.
Burbank, California

17338
High Pressure Eng. Co., Inc.
Oklahoma City, Oklahoma

17545
Atlantic Semiconductors, Inc.
Asbury Park, New Jersey

17856
Siliconix, Inc.
Santa Clara, California

17870
Replaced by 14140

18178
Vactec Inc.
Maryland Heights, Missouri

18324
Signetics Corp.
Sunnyvale, California

18612
Vishay Resistor Products Div.
Vishay Intertechnology Inc.
Malvern, Pennsylvania

18736
Voltronics Corp.
Hanover, New Jersey

18927
G T E Sylvania Inc.
Precision Material Group
Parts Division
Titusville, Pennsylvania

19451
Perine Machinery & Supply Co.
Seattle, Washington

19701
Electro-Midland Corp.
Mepco-Electra Inc.
Mineral Wells, Texas

20584
Enochs Mfg. Inc.
Indianapolis, Indiana

20891
Self-Organizing Systems, Inc.
Dallas, Texas

21604
Buckeye Stamping Co.
Columbus, Ohio

21845
Solitron Devices Inc.
Transistor Division
Riveria Beach, Florida

22767
ITT Semiconductors
Palo Alto, California

23050
Product Comp. Corp.
Mount Vernon, New York

23732
Tracor Inc.
Rockville, Maryland

23880
Stanford Applied Engrng.
Santa Clara, California

23936
Pamotor Div., Wm. J. Purdy Co.
Burlingame, California

24248
Replaced by 94222

24355
Analog Devices Inc.
Norwood, Massachusetts

24655
General Radio
Concord, Massachusetts

24759
Lenox-Fugle Electronics Inc.
South Plainfield, New Jersey

25088
Siemen Corp.
Isilen, New Jersey

25403
Amperex Electronic Corp.
Semiconductor &
Micro-Circuits Div.
Slatersville, Rhode Island

27014
National Semiconductor Corp.
Santa Clara, California

27264
Molex Products
Downers Grove, Illinois

28213
Minnesota Mining & Mfg. Co.
Consumer Products Div.
St. Paul, Minnesota

28425
Serv-/-Link formerly
Bohannan Industries
Fort Worth, Texas

28478
Deltrol Controls Div.
Deltrol Corporation
Milwaukee, Wisconsin

28480
Hewlett Packard Co. Corporate H.Q.
Palo Alto, California

28520
Heyman Mfg. Co.
Kenilworth, New Jersey

29083
Monsanto, Co., Inc.
Santa Clara, California

29604
Stackpole Components Co.
Raleigh, North Carolina

30148
A B Enterprise Inc.
Ahoskie, North Carolina

30323
Illinois Tool Works, Inc.
Chicago, Illinois

31091
Optimax Inc.
Colmar, Pennsylvania

32539
Mura Corp.
Great Neck, New York

32767
Griffith Plastic Corp.
Burlingame, California

32879
Advanced Mechanical Components
Northridge, California

32897
Erie Technological Products, Inc.
Frequency Control Div.
Carlisle, Pennsylvania

32997
Bourns Inc.
Trimpot Products Division
Riverside, California

33173
General Electric Co.
Products Dept.
Owensboro, Kentucky

Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS (Continued)

34333
Silicon General
Westminister, California

34335
Advanced Micro Devices
Sunnyvale, California

34802
Electromotive Inc.
Kenilworth, New Jersey

37942
Mallory, P.R. & Co., Inc.
Indianapolis, Indiana

42498
National Radio
Melrose, Massachusetts

43543
Nytronics Inc.
Transformer Co. Div.
Geneva, New York

44655
Ohmite Mfg. Co.
Skokie, Illinois

49671
RCA Corp.
New York, New York

49956
Raytheon Company
Lexington, Massachusetts

50088
Mostek Corp.
Carrollton, Texas

50579
Litronix Inc.
Cupertino, California

51605
Scientific Components Inc.
Linden, New Jersey

53021
Sangamo Electric Co.
Springfield, Illinois

54294
Cutler-Hammer Inc. formerly
Shallcross, A Cutter-Hammer Co.
Selma, North Carolina

55026
Simpson Electric Co.
Div. of Am. Gage and Mach. Co.
Elgin, Illinois

56289
Sprague Electric Co.
North Adams, Massachusetts

58474
Superior Electric Co.
Bristol, Connecticut

60399
Torin Corp, formerly
Torrington Mfg. Co.
Torrington, Connecticut

63743
Ward Leonard Electric Co., Inc.
Mount Vernon, New York

64834
West Mfg. Co.
San Francisco, Californai

65092
Weston Instruments Inc.
Newark, New Jersey

66150
Winslow Tele-Tronics Inc.
Eaton Town, New Jersey

70485
Atlantic India Rubber Works
Chicago, Illinois

70563
Amperite Company
Union City, New Jersey

70903
Belden Corp.
Geneva, Illinois

71002
Birnbach Radio Co., Inc.
Freeport, LI New York

71400
Bussmann Mfg.
Div. of McGraw-Edison Co.
Saint Louis, Missouri

71450
CTS Corp.
Elkhart, Indiana

71468
ITT Cannon Electric Inc.
Santa Ana, California

71482
Clare, C.P. & Co.
Chicago, Illinois

71590
Centrelab Electronics
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707
Coto Coil Co., Inc.
Providence, Rhode Island

71744
Chicago Miniature Lamp Works
Chicago, Illinois

71785
TRW Electronics Components
Cinch Connector Operations Div.
Elk Grove Village, Chicago, Illinois

72005
Driver, Wilber B., Co.
Newark, New Jersey

72092
Replaced by 06980

72136
Electro Motive Mfg. Co.
Williamantic, Connecticut

72259
Nytronics Inc.
Pelham Manor, New Jersey

72619
Dialight Div.
Amperex Electronic Corp.
Brooklyn, New York

72653
G.C. Electronics
Div. of Hydrometals, Inc.
Brooklyn, New York

72665
Replaced by 90303

72794
Dzus Fastener Co., Inc.
West Islip, New York

72928
Gulton Ind. Inc.
Gudeman Div.
Chicago, Illinois

72982
Erie Tech. Products Inc.
Erie, Pennsylvania

73138
Beckman Instruments Inc.
Helipot Division
Fullerton, California

73293
Hughes Aircraft Co.
Electron Dynamics Div.
Torrence, California

73445
Amperex Electronic Corp.
Hicksville, LI, New York

73559
Carling Electric Inc.
West Hartford, Connecticut

73586
Circle F Industries
Trenton, New Jersey

73734
Federal Screw Products, Inc.
Chicago, Illinois

73743
Fischer Special Mfg. Co.
Cincinnati, Ohio

73899
JFD Electronics Co.
Components Corp
Brooklyn, New York

73949
Guardian Electric Mfg. Co.
Chicago, Illinois

74199
Quan Nichols Co.
Chicago, Illinois

74217
Radio Switch Corp.
Marlboro, New Jersey

74276
Signalite Div.
General Instrument Corp.
Neptune, New Jersey

74306
Piezo Crystal Co.
Carlisle, Pennsylvania

74542
Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970
Johnson E.F., Co.
Waseca, Minnesota

75042
TRW Electronics Components
IRC Fixed Resistors
Philadelphia, Pennsylvania

75376
Kurz-Kasch Inc.
Dayton, Ohio

75378
CTS Knights Inc.
Sandwich, Illinois

75382
Kulka Electric Corp.
Mount Vernon, New York

75915
Littlefuse Inc.
Des Plaines, Illinois

76854
Oak Industries Inc.
Switch Div.
Crystal Lake, Illinois

77342
AMF Inc.
Potter & Brumfield Div.
Princeton, Indiana

77638
General Instrument Corp.
Rectifier Division
Brooklyn, New York

77969
Rubbercraft Corp. of CA. LTD.
Torrance, California

78189
Shakeproof
Div. of Illinois Tool Works Inc.
Elgin, Illinois

78277
Sigma Instruments, Inc.
South Braintree, Massachusetts

78488
Stackpole Carbon Co.
Saint Marys, Pennsylvania

78553
Eaton Corp. Engineered
Fastener Div.
Tinnerman Plant
Cleveland, Ohio

79136
Waldes Kohinoor Inc.
Long Island City, New York

79497
Western Rubber Company
Goshen, Indiana

79963
Zierick Mfg. Corp.
Mt. Kisko, New York

80031
Electro-Midland Corp., Mepco Div.
A North American Phillips Co.
Morristown, New Jersey

80145
LFE Corp., Process Control Div.
formerly API Instrument Co.
Chesterland, Ohio

80183 - use 56289
Sprague Products
North Adams, Massachusetts

80294
Bourns Inc., Instrument Div.
Riverside, California

80583
Hammarlund Mfg. Co., Inc.
Red Bank, New Jersey

80640
Stevens, Arnold Inc.
South Boston, Massachusetts

81073
Grayhill, Inc.
La Grange, Illinois

81312
Winchester Electronics
Div. of Litton Industries Inc.
Oakville, Connecticut

81439
Therm-O-Disc Inc.
Mansfield, Ohio

81483
International Rectifier Corp.
Los Angeles, California

81590
Korry Mfg. Co.
Seattle, Washington

81741
Chicago Lock Co.
Chicago, Illinois

82305
Palmer Electronics Corp.
South Gate, California

82389
Switchcraft Inc.
Chicago, Illinois

Table 7-2. FEDERAL SUPPLY CODES FOR MANUFACTURERS (Continued)

82415
North American Phillips
Controls Corp.
Frederick, Maryland

82872
Roanwell Corp.
New York, New York

82877
Rotron Inc.
Woodstock, New York

82879
ITT Royal Electric Div.
Pawtucket, Rhode Island

83003
Varo Inc.
Garland, Texas

83058
Carr Co., The United Can Div.
of TRW
Cambridge, Massachusetts

83298
Bendix Corp.
Electric Power Division
Eatontown, New Jersey

83330
Smith, Herman H., Inc.
Brooklyn, New York

83478
Rubbercraft Corp. of America, Inc.
West Haven, Connecticut

83594
Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740
Union Carbide Corp.
Battery Products Div.
formerly Consumer Products Div.
New York, New York

84171
Arco Electronics
Great Neck, New York

84411
TRW Electronic Components
TRW Capacitors
Ogallala, Nebraska

84613
Fuse Indicator Corp.
Rockville, Maryland

84682
Essex International Inc.
Industrial Wire Div.
Peabody, Massachusetts

86577
Precision Metal Products,
of Malden Inc.
Stoneham, Massachusetts

86684
Radio Corp. of America
Electronic Components Div.
Harrison, New Jersey

86928
Seastrom Mfg. Co., Inc.
Glendale, California

87034
Illuminated Products Inc.
Subsidiary of Oak Industries Inc.
Anahiem, California

88219
Gould Inc.
Industrial Div.
Trenton, New Jersey

88245
Litton Systems Inc.
Useco Div.
Van Nuys, California

88419
Cornell-Dubilier Electronic Div.
Federal Pacific Co.
Fuquay-Varian, North Carolina

88486
Plastic Wire & Cable
Jewitt City, Connecticut

88690
Replaced by 04217

89536
Fluke, John Mfg. Co., Inc.
Seattle, Washington

89730
G.E. Co., Newark Lamp Works
Newark, New Jersey

90201
Mallory Capacitor Co. Div of
P.R. Mallory Co., Inc.
Indianapolis, Indiana

90211 - use 56365
Square D Co.
Chicago, Illinois

90215
Best Stamp & Mfg. Co.
Kansas City, Missouri

90303
Mallory Battery Co.
Div. of Mallory Co., Inc.
Tarrytown, New York

91094
Essex International Inc.
Suglex/IWP Div.
Newmarket, New Hampshire

91293
Johanson Mfg. Co.
Boonton, New Jersey

91407
Replaced by 58474

91502
Associated Machine
Santa Clara, California

91506
Augat Inc.
Attleboro, Massachusetts

91637
Dale Electronics Inc.
Columbus, Nebraska

91662
Elco Corp.
Willow Grove, Pennsylvania

91737 - use 71468
Gremar Mfg. Co., Inc.
ITT Cannon/Gremar
Santa Ana, California

91802
Industrial Devices, Inc.
Edgewater, New Jersey

91833
Keystone Electronics Corp.
New York, New York

91836
King's Electronics Co., Inc.
Tuckahoe, New York

91929
Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934
Miller Electric Co., Inc.
Div of Aunet
Woonsocket, Rhode Island

92194
Alpha Wire Corp.
Elizabeth, New Jersey

93332
Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145
Replaced by 49956

94154 - use 94988
Wagner Electric Corp.
Tung-Sol Div.
Newark, New Jersey

94222
Southco Inc. formerly
South Chester Corp.
Lester, Pennsylvania

95146
Alco Electronic Products Inc.
Lawrence, Massachusetts

95263
Leecraft Mfg. Co.
Long Island City, New York

95264
Replaced by 98278

95275
Vitramon Inc.
Bridgeport, Connecticut

95303
RCA Corp.
Receiving Tube Div.
Cincinnati, Ohio

95348
Gordo's Corp.
Bloomfield, New Jersey

95354
Methode Mfg. Corp.
Rolling Meadows, Illinois

95712
Bendix Corp.
Electrical Components Div.
Microwave Devices Plant
Franklin, Indiana

95987
Weckesser Co. Inc.
Chicago, Illinois

96733
San Fernando Electric Mfg. Co.
San Fernando, California

96853
Gulton Industries Inc.
Measurement and Controls Div.
formerly Rustrak Instruments Co.
Manchester, New Hampshire

96881
Thomson Industries, Inc.
Manhasset, New York

97540
Master Mobile Mounts
Div. of Whitehall Electronics Corp.
Ft. Meyers, Florida

97913
Industrial Electronic Hdware Corp.
New York, New York

97945
Penwalt Corp.
SS White Industrial Products Div.
Piscataway, New Jersey

97966
Replaced by 11358

98094
Replaced by 49956

98159
Rubber-Teck, Inc.
Gardena, California

98278
Malco A Microdot Co., Inc.
Connector & Cable Div.
Pasadena, California

98291
Sealectro Corp.
Mamaroneck, New York

98388
Royal Industries
Products Div.
San Diego, California

98743
Replaced by 12749

98925
Replaced by 14433

99120
Plastic Capacitors, Inc.
Chicago, Illinois

99217
Bell Industries Elect. Comp. Div.
formerly Southern Elect. Div.
Burbank, California

99392
STM
Oakland, California

99515
ITT Jennings Monrovia Plant
Div. of ITT Jennings formerly
Marshall Industries Capacitor Div.
Monrovia, California

99779 - use 29587
Bunker-Ramo Corp.
Barnes Div.
Landsdowne, Pennsylvania

99800
American Precision Industries Inc.
Delevan Division
East Aurora, New York

99942
Centrelab Semiconductor
Centrelab Electronics Div. of
Globe-Union Inc.
El Monte, California

Toyo Electronics
(R-Ohm Corp.)
Irvine, California

National Connector
Minneapolis, Minnesota

Table 7-3. FLUKE TECHNICAL SERVICE CENTERS

John Fluke Mfg. Co., Inc.
7001 - 220th Ave. S. W.
Mountlake Terrace, WA 98043
Tel: 206-774-2206

Fluke Western Technical Center
2020 N. Lincoln St.
Burbank, CA. 91540
Tel: 213-849-4641

Fluke Western Technical Center
2359 De La Cruz Blvd.
Santa Clara, CA. 95050
Tel: 408-985-1200

Fluke Midwestern Technical Center
10800 Lyndale Ave. So.
Minneapolis, MN 55420
Tel: 612-884-4541

Fluke Midwestern Tech. Ctr.
1287 N. Rand Road
Des Plaines, IL 60016
Tel: 312-298-7470

Fluke Canadian Technical Ctr.
6427 Northam Drive
Mississauga, Ontario
Tel: 416-678-1500

Fluke Canadian Technical Centre
3829 - 12th St. N. E.
Calgary, Alberta T2E 6M5
Tel: 403-261-0780

Fluke Eastern Tech. Center
500 Union Blvd.
Totowa, NJ 07512
Tel: 201-742-3215

Fluke N. E. Tech. Ctr.
109 Massachusetts Ave.
Lexington, MA 02173
Tel: 617-861-8620

Fluke Mideastern Tech. Ctr.
11501 Huff Court
Kensington, MD. 20795
Tel: 301-881-5300

Fluke S. E. Technical Ctr.
P.O. Box 6578
940 N. Fern Creek Ave.
Orlando, FL 32803
Tel: 305- 896-2296

Fluke S. E. Technical Center
P. O. Box 9619
1310 Beaman Place
Greensboro, NC 27408
Tel: 919-273-1918

Fluke Southwestern Tech. Ctr.
1980 S. Quebec St.
Unit 4
Denver, CO 80231
Tel: 303-750-1228

Table 7-4. INTERNATIONAL SERVICE CENTERS

Fluke (Nederland) B.V.
P.O. Box 5053
Zevenheuvelenweg 53
Tilburg, Netherlands
Tel: (13) 673973

Fluke International Corporation
Garnet Close
Watford, WD-2 4TT, England
Tel: 0923-33066

Coasin S. A.
Virrey del Pino 4071
Buenos Aires, Argentina
Tel: 523185

Elmeasco Instruments Pty Ltd.
P. O. Box 334
Brookvale, N.S.W.
Australia 2100
Tel: (02 939-7944

Ambriex S. A.
Rua Ceara, 104 - 2.° e 3.° Andares
ZC - 29
Rio de Janeiro GB, Brazil
Tel: 264-7406

Rua Tupi, 535
01233 Sao Paulo SP, Brazil
Tel: 52-7806 & 0912

Proteco Coasin CIA, Ltda.
Apartado 228A
Quito, Ecuador
Tel: 526759

M.B. Electronique S. A.
29, Rue Emile Duclaux
92150, Suresnes, France
Tel: 7723111 (108)

Gilman & Co., Ltd.
P. O. Box 56
Hong Kong
Tel: 227011 (14)

Hinditron Services Pvt Ltd.
69/ A.L. Jagmohandas Marg.
Bombay - 400 006, India
Tel: 365344

Berkeh Company Ltd.
20 Salm Raod, Roosevelt Ave.
Tehran, Iran
Tel: 828294 831564

R.D.T. Electronics Engineering Ltd.
46, Sokolov Street
Ramat Hasharon 47235 Isreal
Tel: 483211

Toyo Trading Company, Ltd.
P. O. Box 5014
International Tokyo
Tokyo 100-31, Japan
Tel: (03) 279-0771

Mexitek, S. A.
Eugenia 408
Department 1
Mexico 12, D.F.
Mexico
Tel: 5360910-5239751

C. N. Rood N. V.
13, Cort van der Lindenstraat
P. O. Box 42
Rijswijk ZH 2100
Netherlands
Tel: 070-996360

Morgenstierne & Co. A/S
Konghellgate 3
P.O. Box 6688, Rodelokka
Oslo 5, Norway
Tel: 472-356110

Brixton Trading Company, Inc.
Suite 36 Metropolitan Bank Bldg.
Ayala Avenue
Makati, Rizal D-708, Phillippines
Tel: 88-27-06, 88-58-90

Elairco (Pty) Ltd.
P. O. Box 13091
Benoni 1511
Transvaal
Republic of South Africa
Tel: 54-5513 - 547571

Coasin C. A.
Apdo, Postal 50939
Sabana Grande No. 1
Caracas 105, Venezuela
Tel: 722311 - 728662

Table 7-5. SALES REPRESENTATIVES - DOMESTIC

ALABAMA

HUNTSVILLE
BCS Associates, INc.
3322 S. Memorial Parkway
P.O. Box 1273
Tel. (205) 881-6220
Zip 35807

ALASKA

ANCHORAGE
Harry Lang & Associates
1406 W. 47th Ave.
Tel. (907) 279-5741
Zip 99503

ARIZONA

PHOENIX
Barnhill Associates
7319 E. Stetson Dr.
Tel. (602) 947-7841
Scottsdale, AZ 85251

CALIFORNIA

LOS ANGELES
Instrument Specialists, Inc.
2020 N. Lincoln Street
Burbank, CA 91504
Tel. (213) 849-7181

NEWPORT BEACH
Instrument Specialists, Inc.
4120 Birch Street
Suite 119
Tel. (714) 752-6200
Zip 92660

SANTA CLARA
Instruments Specialists, Inc.
2359 De La Cruz Blvd.
Tel. (408) 244-1505
Zip 95050

COLORADO

DENVER
Barnhill Associates, Inc.
1980 South Quebec St. Unit 4
Tel. (303) 750-1222
Zip 80231

CONNECTICUT

HARTFORD
Instrument Representatives, Inc.
P. O. Box 518
Glastonbury, CT 06033
Tel. (203) 633-0777

FLORIDA

ORLANDO
BCS Associates, Inc.
940 N. Fern Creek Ave.
Tel. (305) 896-4881
Zip 32803

GEORGIA

DECATUR
BCS Associates, Inc.
2522 Tanglewood Road
Tel. (404) 321-0980
Zip 30033

HAWAII

HONOLULU
Industrial Electronics, Inc.
646 Queen Street
P. O. Box 135
Tel. (808)533-6095
Zip 96817

ILLINOIS

CHICAGO
Cozzens & Cudahy, Inc.
1301 N. Rand Road
Des Plaines, IL 60016
Tel. (312) 298-3600

INDIANA

INDIANAPOLIS
Cozzens & Cudahy, Inc.
Port O'Call Executive Ctr.
21 Beachway Drive
Tel:(317) 244-2456
Zip: 46224

KENTUCKY

VALLEY STATION
BCS Associates, Inc.
4506 Freda Way
Tel: (502) 935-9634
Zip: 40272

MARYLAND

BALTIMORE
Electronic Marketing Assoc. Inc.
11501 Huff Court
Kensington, MD 20795
Tel: (301) 881-5300, 744-7700

MASSACHUSETTS

BOSTON
Instrument Representatives, Inc.
109 Massachusetts Ave.
Lexington, MA 02173
Tel. (617) 861-8620

MICHIGAN

DETROIT
WKM Associates, Inc.
345 Girard
Madison Hts, MI, 48071
Tel: (313) 588-2300

MINNESOTA

MINNEAPOLIS
Cozzens & Cudahy, Inc.
10800 Lyndale Ave. S. 55420
Tel: (612) 884-4336

MISSOURI

KANSAS CITY
Cozzens & Cudahy, Inc.
4404 Chouteau Traffic Way
Tel. (816) 454-5836
Zip 64117

ST. LOUIS
Cozzens & Cudahy Inc.
P. O. Box 10013
Lambert Field - Zip 63145
Tel: (314) 423-1234

NEW JERSEY

NEWARK
SBM Representatives
1519A Stuyvesant Avenue
Union, NJ 07083
Tel: (201) 687-8737

NEW MEXICO

ALBUQUERQUE
Barnhill Associates
1410 - D Wyoming N. E.
Tel (505) 299-7658
Zip: 87112

NEW YORK

NEW YORK
SBM Representatives
28 Hobby Street
Pleasantville, NY 10570
Tel (914) 769-1811

ROCHESTER
SBM Representatives
4515 Culver Road
Tel. (716) 226-1400
Zip 14622

NORTH CAROLINA

GREENSBORO
BCS Associates, Inc.
P.O. Box 9619
1310 Beaman Place
Tel. (919) 273-1918
Zip 27408

OHIO

CLEVELAND
WKM Associates, Inc.
16141 Puritas Ave.
Tel. (216) 267-0445
Zip 44135

DAYTON
WKM Associates, Inc.
7913 So. Suburban Road
Tel. (513) 434-7500
Zip: 45459

Table 7-5. SALES REPRESENTATIVES - DOMESTIC (Continued)

OREGON

BEAVERTON

Showalter Instruments, Inc.
3800 S.W. Cedar Hills Blvd.
Suite 160
Tel: (503) 646-5196
Zip 97005

PENNSYLVANIA

PHILADELPHIA

Electronic Marketing Assoc.
210 Goddard Blvd. Ste. 100
King of Prussia, PA
Tel. (215) 248-5050
Zip 19406

PITTSBURGH

WKM Associates, Inc.
90 Clairton Blvd.
Tel. (412) 892-2953
Zip 15236

TEXAS

DALLAS

Barnhill Associates
908 Business Parkway
Richardson, TX 75080
Tel. (214) 231-2573

HOUSTON

Barnhill Associates
10606 Hempstead Hwy.
Suite 132
Tel. (713) 688-9971
Zip 77092

VIRGINIA

WILLIAMSBURG

BCS Associates
107 Rich Neck Road
Tel. (804) 877-4053
Zip: 23185

WASHINGTON

SEATTLE

Showalter Instruments, Inc.
1521 - 130 N. E.
Bellevue, WA 98005
Tel. (206) 455-4922
(206) 624-4035

CANADA

BRITISH COLUMBIA

NORTH VANCOUVER

Allan Crawford Associates, Ltd.
116 E. 3rd St. Suite 203
Tel: (604) 980-4831

ALBERTA

CALGARY

Allan Crawford Associates, Ltd.
3829 - 12th St. N. E. T2E 6M5
Tel. (403) 276-9658

ONTARIO

MISSISSAUGA

Allan Crawford Associates, Ltd.
6427 Northern Drive
Tel. (416) 678-1500

OTTAWA, 3

Allan Crawford Associates, Ltd.
1299 Richmond Road K2B 7Y4
Tel. (613) 829-9651

QUEBEC

LONGUEUIL

Allan Crawford Associates, Ltd.
1330 Marie Victorian Blvd. East
Longueuil Br. P.Q. J4G 1A2
Tel (514) 670-1212

NOVA SCOTIA

DARTMOUTH

Allan Crawford Associates, Ltd.
St. 201, Townsend Pl.
800 Windmill Rd.
Burnside Industrial Park
Dartmouth, N. S. B3B 1L1
Tel (902) 469-7865

Table 7-6. SALES REPRESENTATIVES — INTERNATIONAL

Argentina
Coasin S.A.
Virrey del Pino 4071
Buenos Aires, Argentina
Tel: 523185

Austria
Kontron GmbH & Co. KG.
Ameisgasse 49
1140 - Vienna, Austria
Tel: 09-43222945646

Australia
Elmeasco Instruments, Pty Ltd.
P.O. Box 334
Brookvale, N.S.W.
Australia 2100
Tel: (02) 939-7944

Belgium
C.N. Rood S.A.
37, Place de Jamblinee de Meux
B-1040 Brussels, Belgium
Tel: 02-27352135

Brazil
Ambriex S.A.
Rua Ceara, 104 - 2°. e 3°. Andares
ZC-29
Rio de Janeiro GB, Brazil
Tel: 264-7406

Ambriex S. A.
Rua Tupi, 535
01233 Sao Paulo SP, Braxil
Tel: 52-7806 & 0912

Caribbean
West Indies Sales Co., Ltd.
7360 N. W. 66th St.
Miami, FL 33166
Tel: (305) 592-8188

Central America
Intermetra Corp
11 Park Place, Suite 2003
New York, NY 10007
Tel (212) 349-7630, 31, 32

Chile
Coasin Chile Ltd.
Casilla 14588 - Correo 15
Santiago, Chile
Tel: 396713

China
May Lee Industries, Inc.
111 Broadway, Suite 510
New York, NY 10006
Tel: (212) 349-5780

Columbia
Asistec Limitada
Apartado Aereo 12322
Bogota 1, Colombia
Tel: 419331

Cyprus
Chris Radiovision Ltd.
P. O. Box 1989
Nicosia, Cyprus
Tel: 66121

Denmark
Tage Olsen A/S
Teglvaerksgade 37
DK-2100 Copenhagen 0
Denmark
Tel: 01-294800

Eastern Europe Countries
Elpro GmbH
Molkergasse 4
1080 - Vienna, Austria
Tel: 222 424692

Ecuador
Proteco Coasin CIA, Ltda.
Apartado 228A
Quito, Ecuador
Tel: 526759

Egypt
Lotus Engineering Organisation
P. O. Box 1252
Cairo, Egypt
Tel: 71617

Table 7-6. SALES REPRESENTATIVES – INTERNATIONAL (Continued)

Finland
OY Findip AB
Teollisuustie 7
02700 Kaunianen
Finland
Tel: 502255

France
M.B. Electronique S.A.
29,Rue Emile Duclaux
92150, Suresnes France
Tel: 7723411 (108)

Germany
Fluke (Deutschland) GmbH
4-Dusseldorf
Meineckestrasse 53
West Germany
Tel: 450831

Greece
Hellenic Scientific Representations Ltd.
10, Nympheau Street
Athens 615 Greece
Tel: 7792320/705960

Hong Kong & Macao
Gilman & Co., Ltd.
P.O. Box 56
Hong Kong
Tel: 227011 (14)

India
Hinditron Services Pvt. Ltd.
69/A. L. Jagmohandas Marg
Bombay - 400 006, India
Tel: 365344

Indonesia
P.T. United Dico-Citas Co., Ltd.
JLN Penjaringan 39A
Jakarta, Indonesia

Iran
Berkeh Company Ltd.
20 Salm Road. Roosevelt Ave.
Tehran, Iran
Tel: 828294 831564

Isreal
R.D.T. Electronics Engineering Ltd.
46, Sokolov St
Ramat Hasharon 47235 Isreal
Tel: 483211

Italy
Sistrel, S. p.A.
Via Giorgio da Sebenico 11-13
00143 Roma, Italy
Tel: 06-500-1860

Japan
Toyo Trading Company, Ltd.
P.O. Box 5014
International Tokyo
Tokyo 100-31, Japan
Tel: (03) 279-0771

Toyo Trading Company, Ltd.
Suzuki Bldg.
2-38 Junkeicho-dori
Minami-ku, Osaka, Japan
Tel: (06) 262-3471

Kenya
Advanced Communications, Ltd.
City House, Wabera Street
P.O. Box 30635
Nairobi, Kenya
Tel: 31955

Korea
Asia Science & Co.
International P. O. Box 1250
Seoul, Korea
Tel: 76-2761

Kuwait
Tareq Company
P.O. Box Safat 20506
Kuwait, Arabian Gulf
Tel: 436100, 436045

Lebanon
General Marketing Trading &
Contracting Company
Anis Nsouli Street
Nsouli Building
P.O. Box 155.655
Beirut, LEbanon
Tel: 319383, 312061

Malaysia
O'Connor's (PTE) Limited
P.O. Box 91
Petaling Jaya, Selangor
West Malaysia
Tel: 51563

Mexico
Mexitek, S.A.
Eugenia 408
Department 1
Mexico 12, D.F.
Mexico
Tel: 5360910 - 5239751

Morocco
S.I.E.E.M.
Residence Moulay Ismail
Bat. C.
Boulevard Moulay Slimane
Rabat, Morocco
Tel: 276-64

Netherlands
C N. Rood B.V.
13, Cort van der Lindenstraat
P.O. Box 42
Rijswijk ZH 2100
Netherlands
Tel: 070-996360

Fluke (Nederland) B.V.
P.O. Box 5053
Zevenheuvelenweg 53
Tilburg, Netherlands
Tel: (13) 673973

New Zealand
Elmeasco Instruments Pty Ltd.
P.O. Box 30515
LOWER HUTT
New Zealand
Tel: 697566

Nigeria
Deemtee Electrotechnics, Ltd.
P.O. Box 3073
Lagos, Nigeria

Norway
Morgenstierne & Co. A/S
Konghellegate 3
P.O. Box 6688, Rodelokka
Oslo 5, Norway
Tel: (02) 372940

Pakistan
Pak International Operations
505 Muhammadi House - McLeod Rd.
P.O. Box 5323
Karachi, Pakistan

Peru
Importaciones Y Representaciones
Electronicas S. A.
Avda, Franklin D. Roosevelt 105
Lima 1, Peru
Tel: 27-2078

Phillippines
Brixton Trading Company, Inc.
Suite 636 Metropolitan Bank Bldg.
Ayala Avenue
Makati, Rizal D-708, Phillippines
Tel: 88-27-06, 88-58-90

Portugal
Equipamentos De Laboratorio Lda.
P.O. Box 1100
Lisbon 1, Portugal
Tel: 976551

Singapore
O'Connor's (PTE) Limited
98 Pasir Panjang Road
Singapore 5, Singapore
Tel: 637944

Table 7-6. SALES REPRESENTATIVES – INTERNATIONAL (Continued)

South Africa
Elairco (Pty) Ltd.
P.O. Box 13091
Benoni 1511
Transvaal
Republic of South Africa
Tel: 54-5513 - 547571

Spain
Ataio Ingenieros S. A.
Enrique Larreta 12
Madrid 16, Spain
Tel: 7330562

Sweden
Teleinstrument AB
P.O. Box 490
Maltesholmvagen 490
S-162 04 Vallingby
Sweden
Tel: 08-380379

Switzerland
Kontron Electronic A.G.
Bernerstrasse-Sub 169
8048 Zurich. Switzerland
Tel:01-628282

Taiwan
Heighten Trading Co, Ltd.
P.O. Box 1408
Taipei, Taiwan 100
Republic of China
Tel: 5118324 - 5118372

Thailand
Dynamic Supply Engineering R.O.P.
No. 56 Ekamai, Sukhumvit 63
Bangkok 11, Thailand
Tel: 914434, 928532

Turkey
M. Suheyl Erkman
Necatibey Cad. 92/2
Karakoy/Istanbul
Turkey
Tel: 441546 - 447651

The United Kingdom
Fluke International Corporation
Garnet Close
Watford, WD 2 4 TT
England
Tel: 0923-33066

U. S. S. R.
Codevintec Pacific Inc.
6263 Variel
Woodland Hills, CA 91364
Tel: (213) 348-1719

Uruguay
Coasin,Uruguaya S. R. L.
Cerrito 617 - 4° Piso
Montevideo, Uruguay

Venezuela
Coasin C. A.
Apdo, Postal 50939
Sabana Grande No. 1
Caracas 105, Venezuela
Tel: 722311 - 728662

In Europe, contact FLUKE NEDERLAND, B.V., P.O. Box 5053, Industrieterrein Noord, Tilburg, The Netherlands.....

FLUKE REGIONAL SERVICE CENTER: The NETHERLANDS
FLUKE (NEDERLAND) B.V.
P.O. BOX 5053
TILBURG, THE NETHERLANDS

FLUKE REGIONAL SERVICE CENTER, UNITED KINGDOM
FLUKE INTERNATIONAL CORP.
GARNETT CLOSE
WATFORD, WD24TT ENGLAND.

AUTHORIZED SERVICE LABORATORIES INTERNATIONAL

EACH INTERNATIONAL REPRESENTATIVE IS EQUIPPED WITH AN AUTHORIZED SERVICE LABORATORY, PLEASE REFER TO THE INTERNATIONAL REPRESENTATIVE LISTING FOR YOUR SERVICE NEEDS.

Section 8
Schematic Diagrams

SCHEMATIC DIAGRAMS

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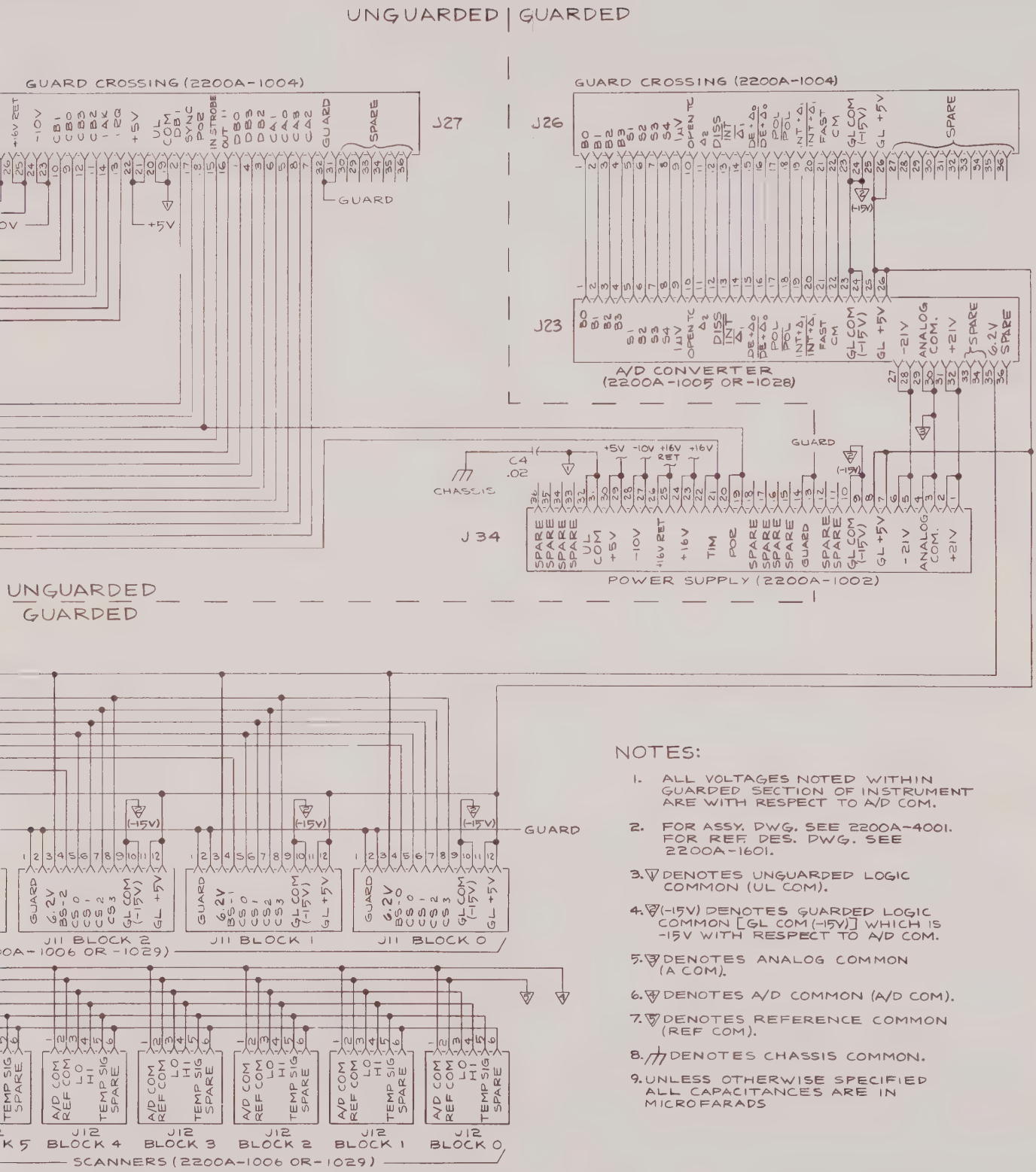
8-22.	Range and Function Memory PCB Assembly (2 sheets)	2240A-1032	8-49

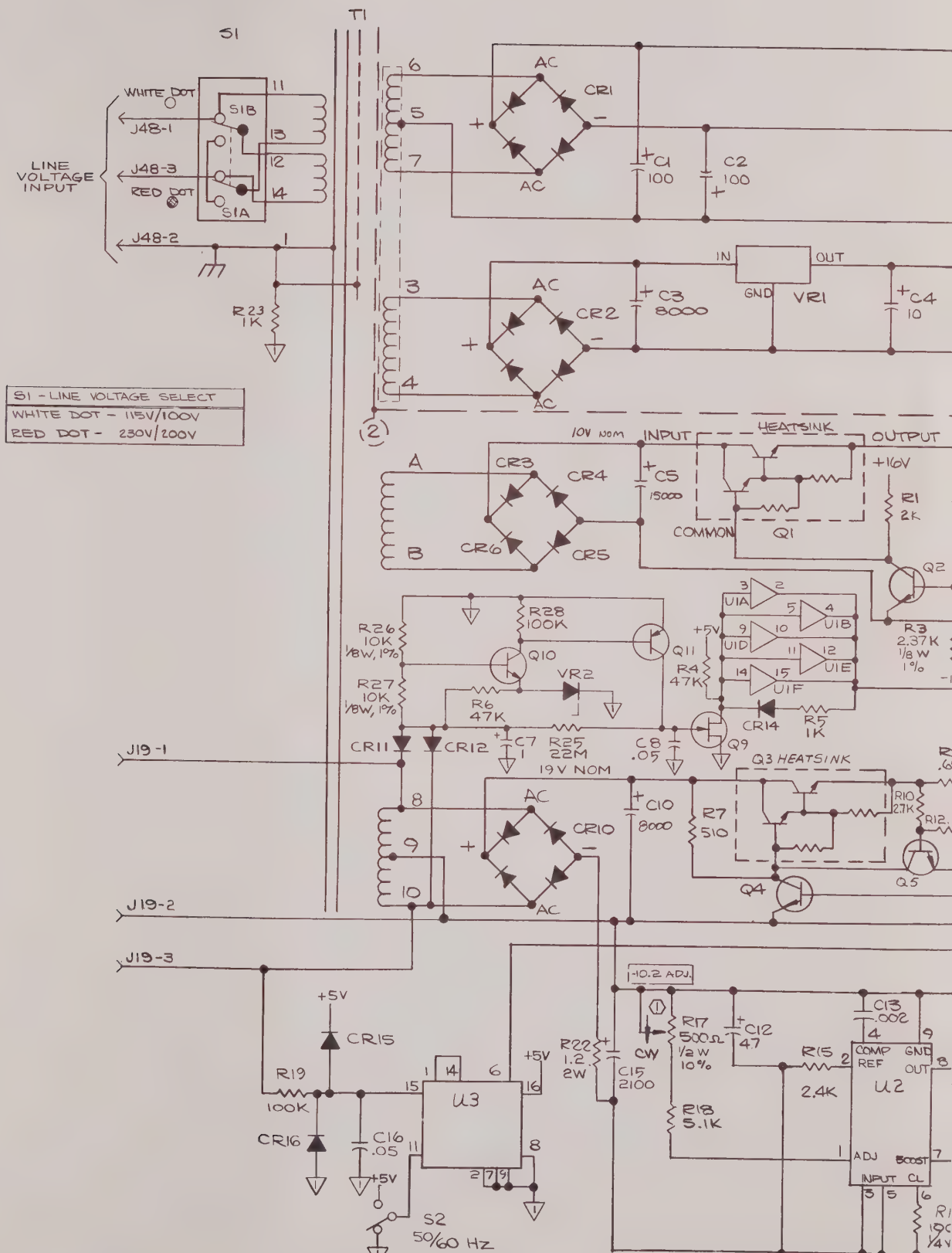
J28 4 PLACES:
TELETYPE INTERFACE (2200A-1014)
PAPERTAPE INTERFACE (2200A-1015)
MAGNETIC TAPE INTERFACE (2200A-1016)
DIGITAL INPUT (2200A-1017)
PROM (2200A-1027 OR 2240A-1027)
R/F MEMORY (2240A-1032)
ALARMS OUTPUT (2240A-1031)
J32: CONTROLLER (2200A-1003)
CONTROL BUS 2:
J1: KYBD MEMORY (2240A-1013)
J5: PRINTER DRIVE (2200A-1007)
CONTROL BUS 1:
J3: PRINTER DRIVE (2200A-1007)
J7: BASIC PRGMMER (2200A-1010) KYBD MEM. (2240A-1013)
-10V
+16V RET.
+16V
+5V
J 25
A/D CONVERTER (2200A-1005 OR -1028)
GUARD
C1 .02
CHASSIS COMMON
(-15V)
J11 BLOCK 5
J11 BLOCK 4
J11 BLOCK 3
SCANNERS (220
CONTROL BUS 3
(OPA MEMORY):
J9: BLOCK PRGMMER/MEMORY (2200A-1031) OR KYBD MEMORY (2240A-1013)
CONTROLLER (2200A-1003)
J31
J24
A/D CONV. (2200A-1005 OR -1028)
UNGUARDED
GUARDED

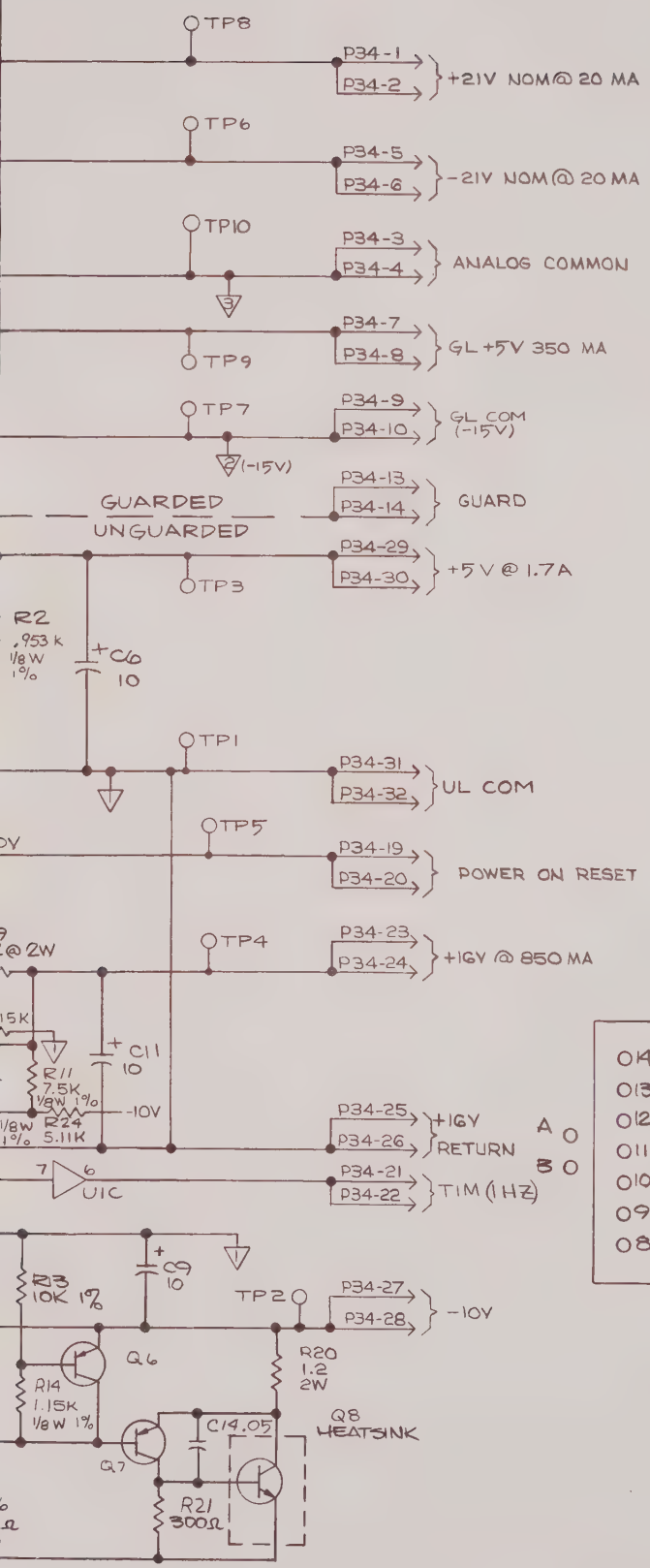


NOTES:

1. ALL VOLTAGES NOTED WITHIN GUARDED SECTION OF INSTRUMENT ARE WITH RESPECT TO A/D COM.
2. FOR ASSY. DWG. SEE 2200A-4001. FOR REF. DES. DWG. SEE 2200A-1601.
3. ▽ DENOTES UNGUARDED LOGIC COMMON (UL COM).
4. ▽ (-15V) DENOTES GUARDED LOGIC COMMON [GL COM (-15V)] WHICH IS -15V WITH RESPECT TO A/D COM.
5. ▽ DENOTES ANALOG COMMON (A COM).
6. ▽ DENOTES A/D COMMON (A/D COM).
7. ▽ DENOTES REFERENCE COMMON (REF COM).
8. ⏚ DENOTES CHASSIS COMMON.
9. UNLESS OTHERWISE SPECIFIED ALL CAPACITANCES ARE IN MICROFARADS

FIGURE 8-1. MOTHER BOARD PCB ASSEMBLY (2200A–1001)


T1
S1
WHITE DOT
J48-1
S1B
J48-3
RED DOT
S1A
J48-2
LINE VOLTAGE INPUT
R23 1K
AC
CR1
C1 100
C2 100
CR2
C3 8000
IN
OUT
GND
VR1
C4 10
S1 - LINE VOLTAGE SELECT
WHITE DOT - 115V/100V
RED DOT - 230V/200V
10V NOM
INPUT
HEATSINK
OUTPUT
+16V
CR3
CR4
CR5
CR6
C5 15000
COMMON
Q1
R1 2K
Q2
R3 2.37K 1/8 W 1%
R26 10K 1/8W, 1%
R27 10K 1/8W, 1%
R28 100K
Q10
Q11
VR2
R6 47K
R4 47K
+5V
U1A
U1B
U1D
U1E
U1F
CR14
R5 1K
Q9
CR11
CR12
C7 1
R25 22M
19V NOM
C8 .05
Q3 HEATSINK
J19-1
J19-2
J19-3
C10 8000
R7 510
R10 27K
R12
Q4
Q5
-10.2 ADJ.
CR15
R19 100K
CR16
C16 .05
U3
S2
50/60 Hz
R22 1.2 2W
C15 2100
CW
R17 500Ω 1/2 W 10%
R18 5.1K
C12 47
C13 .002
R15 2.4K
U2
COMP
REF
GND
OUT
ADJ
BOOST
INPUT CL



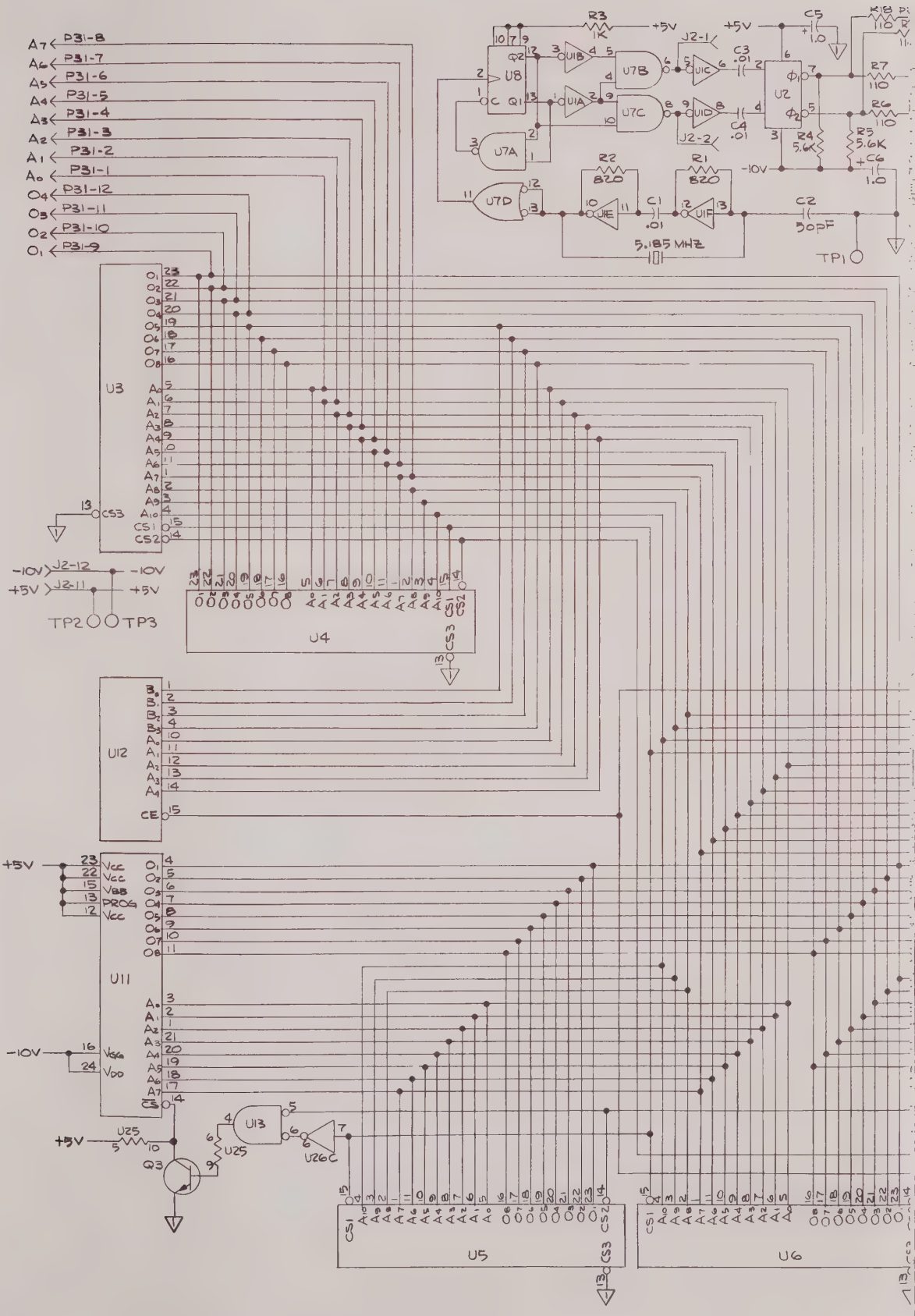
I.C. REF. DES.	PIN NO. +5V	PIN NO. UL COM
U1	1,16	8

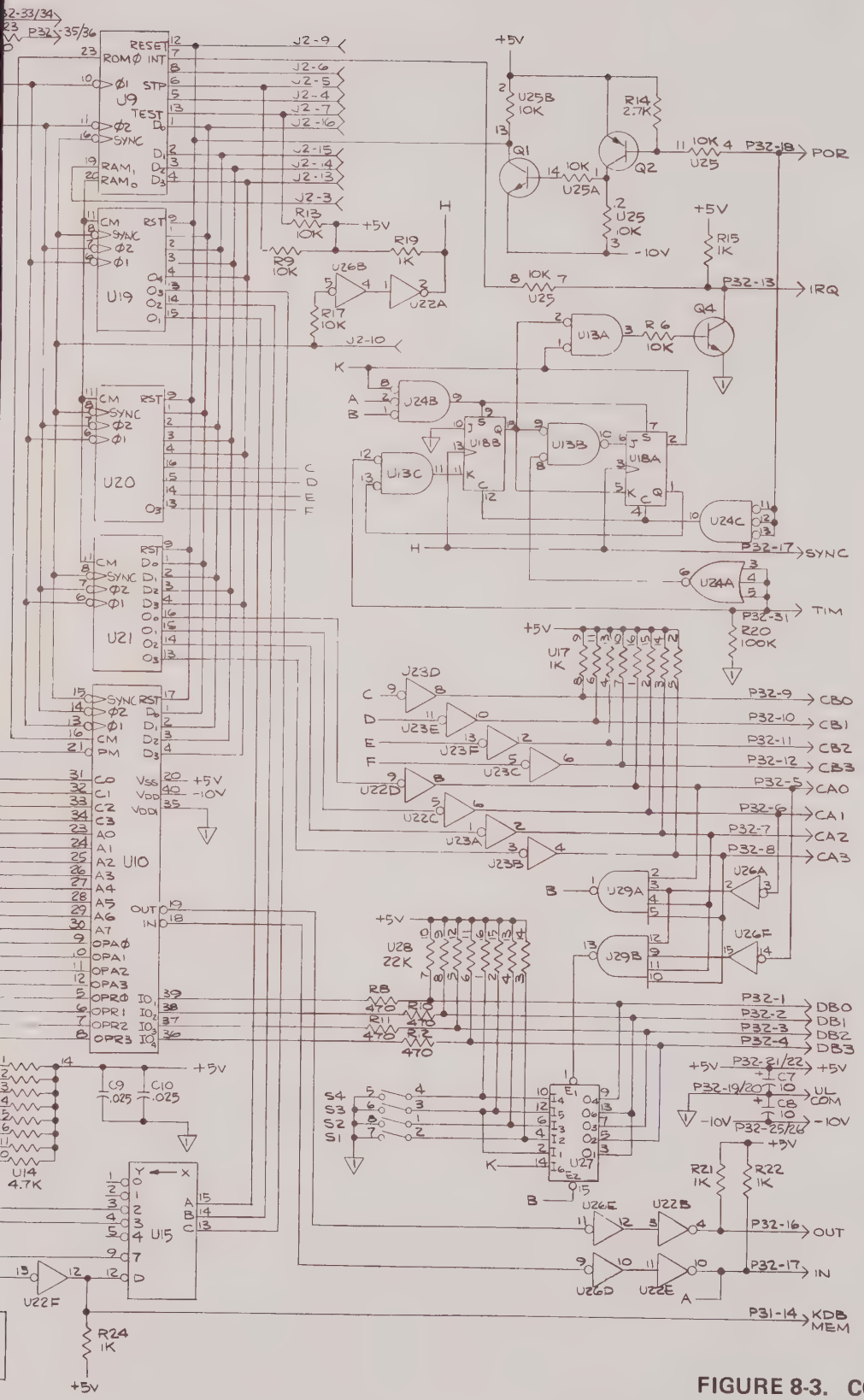
REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
C16	U3	CR7-9,	
CR16	VR2	CR13	
Q11		R8	
R28			
S2			
T1			
TP9			

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. FOR ASSEMBLY DRAWING SEE 2200A-4002.
3. ⬡ DENOTES CALIBRATION ADJ POINTS. ALL POINTS ARE SCREWDRIVER ADJUST.
4. ALL RESISTORS ARE 1/4 W, 5% UNLESS OTHERWISE SPECIFIED.
5. ALL GRAPHIC SYMBOLS ARE IN ACCORDANCE WITH ANSI Y32.14 AND Y32.2.
6. ▽2 (-15V) DENOTES GUARDED LOGIC COMMON [GL COM (-15V)] WHICH IS -15V WITH RESPECT TO A/D COM.
7. ▽3 DENOTES ANALOG COMMON.
8. ▽1 DENOTES UNGUARDED LOGIC COMMON (UL COM)
9. ALL VOLTAGES NOTED WITHIN GUARDED SECTION OF INSTRUMENT ARE WITH RESPECT TO A/D COM.

FIGURE 8-2. POWER SUPPLY PCB ASSEMBLY (2200A–1002)


A7 P31-8
A6 P31-7
A5 P31-6
A4 P31-5
A3 P31-4
A2 P31-3
A1 P31-2
A0 P31-1
O4 P31-12
O5 P31-11
O2 P31-10
O1 P31-9
U3
U4
U12
U11
U13
U25
Q3
U5
U6
U8
U7A
U7B
U7C
U7D
U1A
U1B
U1C
U1D
U1E
U1F
U2
R3 1K
R1 820
R2 820
R4 5.6K
R5 5.6K
R6 110
R7 110
C1 .01
C2 50pF
C3 .01
C4 .01
C5 1.0
C6 1.0
5.185 MHZ
+5V
-10V
J2-1
J2-2
J2-12
J2-11
TP1
TP2
TP3

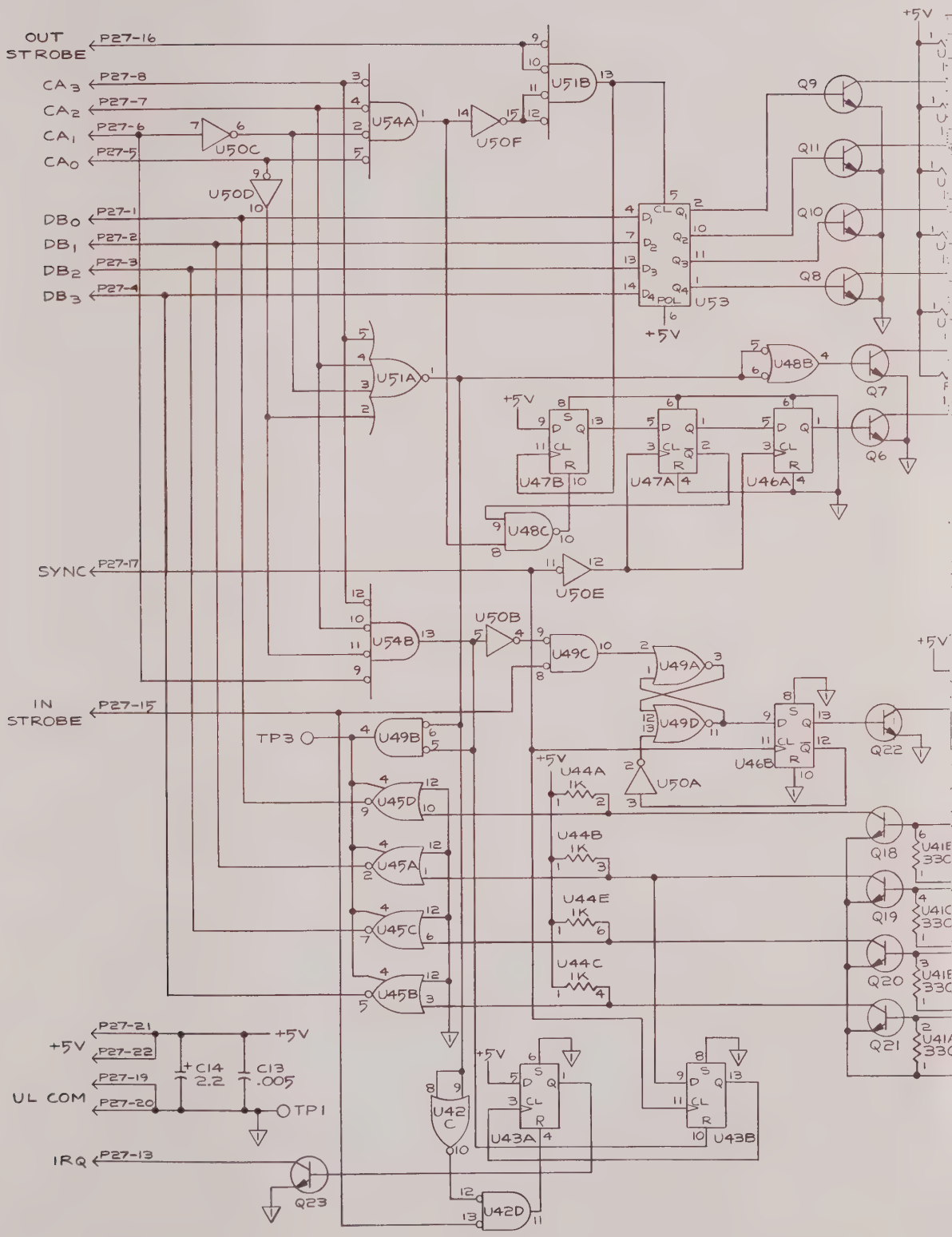


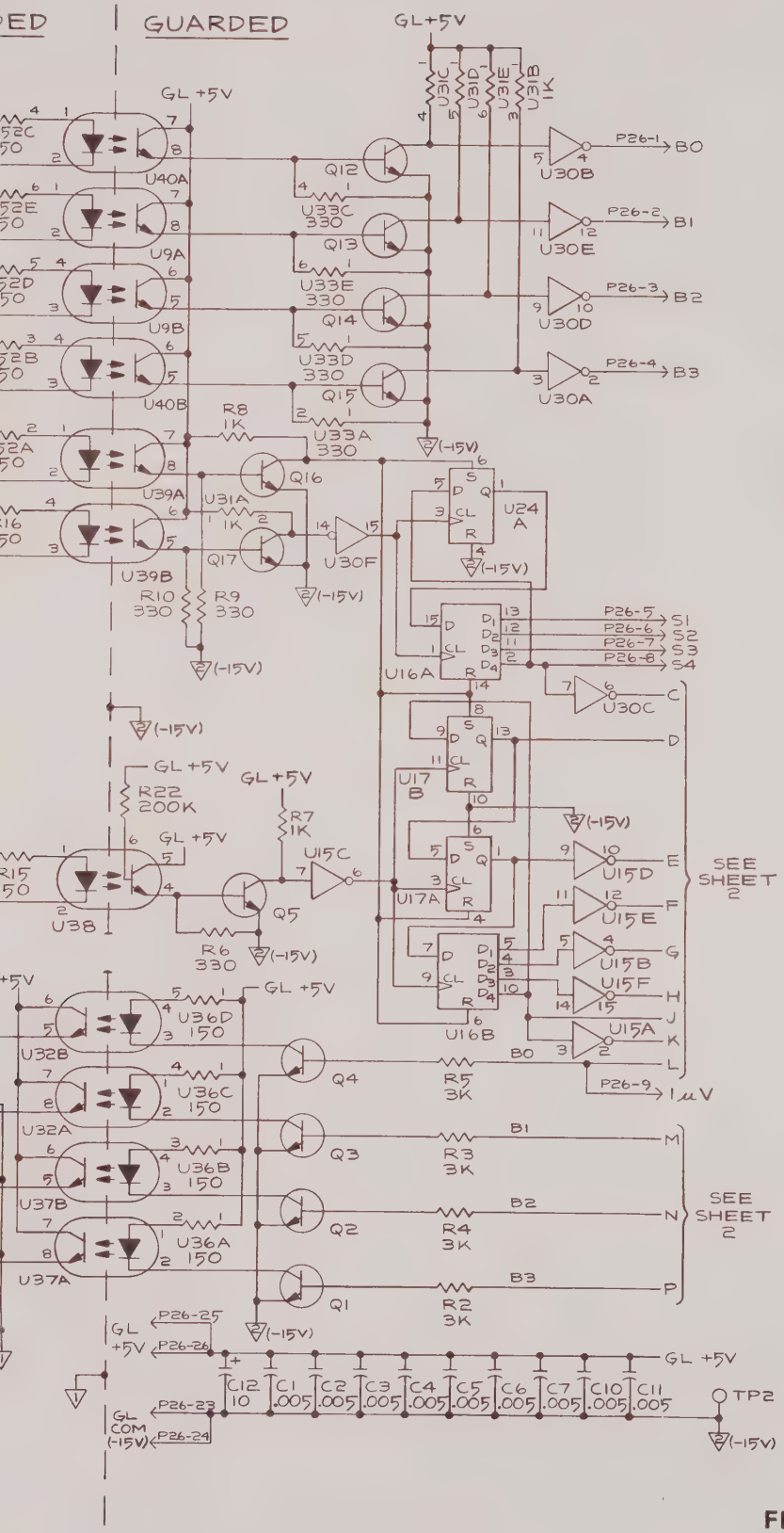
IC REF DESIG.	PIN NO. +5V	UL COM	-10V
U1	14	7	—
U2	6	—	3
U7	14	7	—
U8	16	8	—
U9	9	—	21,5,14
U10	20	35	40
U13	14	7	—
U15	16	8	—
U18	16	8	—
U19	5,10	—	12
U20	5	—	12,10
U21	5,10	—	12
U22	14	7	
U23	14	7	
U24	14	7	
U26	16,1	8	
U27	16	8	
U29	14	7	
U3	24	12	
U4	24	12	
U5	24	12	
U6	24	12	
U11			
U12	16	8	

REFERENCE DESIGNATIONS	
LAST USED	NOT USED
U29	U16

NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ▽ DENOTES UNGUARDED LOGIC COMMON (UL COM).
3. ALL RESISTORS ARE 1/4W ±5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS ARE IN ACCORDANCE WITH ANSI Y32.2 AND Y32.14.
5. FOR ASSY DWG SEE 2200A-4003 FOR REF. DES. DWG SEE 2200A-1603

FIGURE 8-3. CONTROLLER PCB ASSEMBLY (2200A–1003)


OUT STROBE
P27-16
CA3
P27-8
CA2
P27-7
CA1
P27-6
CA0
P27-5
DB0
P27-1
DB1
P27-2
DB2
P27-3
DB3
P27-4
SYNC
P27-17
IN STROBE
P27-15
U54A
U54B
U50C
U50D
U50E
U50F
U51A
U51B
U53
U47B
U47A
U46A
U48B
U48C
U49A
U49B
U49C
U49D
U50A
U50B
U44A
U44B
U44C
U44E
U45A
U45B
U45C
U45D
U46B
U42C
U42D
U43A
U43B
Q6
Q7
Q8
Q9
Q10
Q11
Q18
Q19
Q20
Q21
Q22
Q23
+5V
TP3
TP1
C14 2.2
C13 .005
UL COM
P27-21
P27-22
P27-19
P27-20
IRQ
P27-13



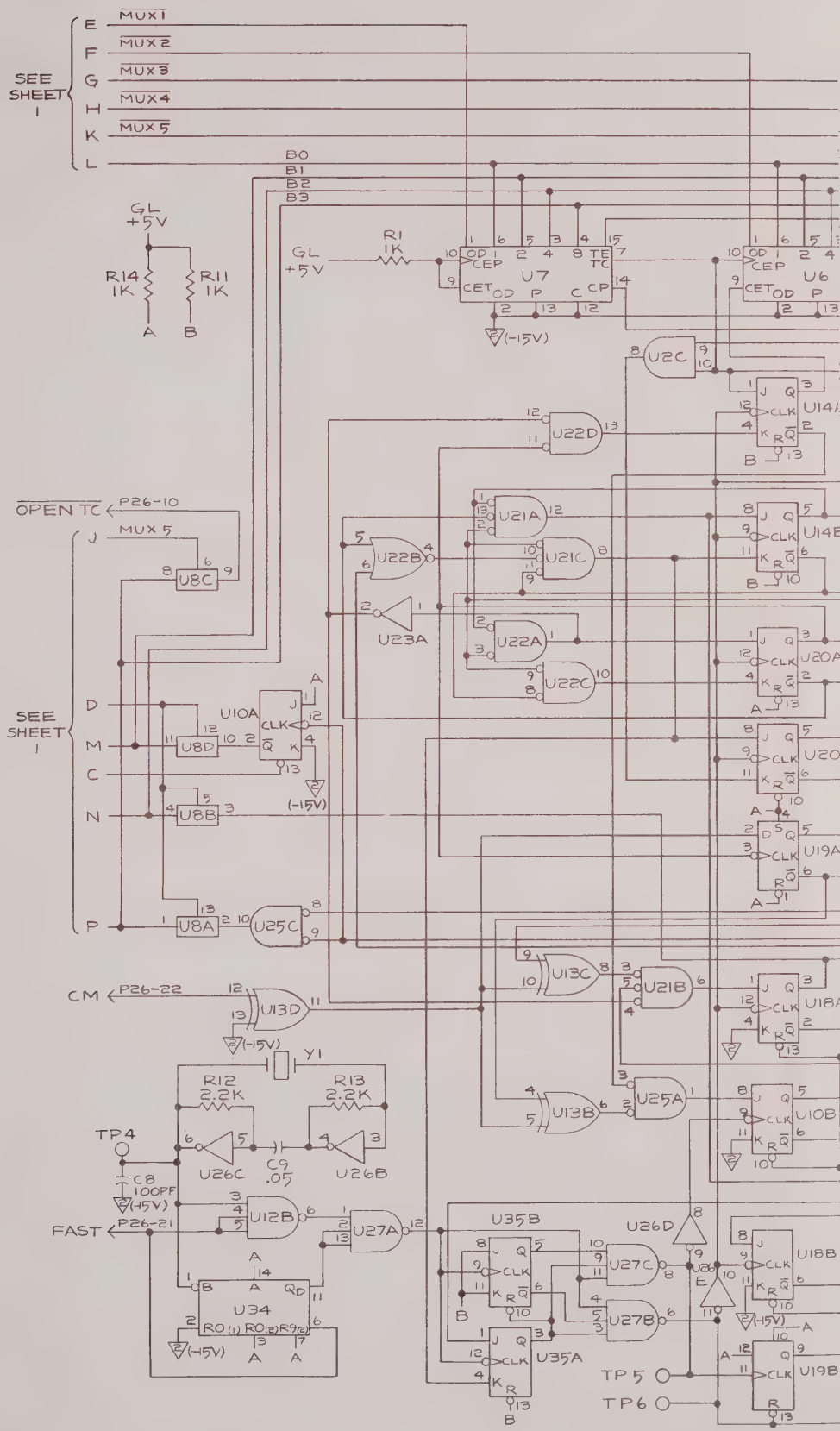
NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.14 AND Y32.2.
5. FOR ASSY. DWG. SEE 2200A-4004. FOR REF. DES. DWG. SEE 2200A-1604.
6. ▽ DENOTES UNGUARDED LOGIC COMMON (UL COM).
7. ▽ (-15V) DENOTES GUARDED LOGIC COMMON [GL COM (-15V)] WHICH IS -15V WITH RESPECT TO A/D COM.
8. ALL VOLTAGES NOTED WITHIN GUARDED SECTION OF INSTRUMENT ARE WITH RESPECT TO A/D COM.

REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
C21		C9,15-19	
Q23			
R22		R1,17-19	
U54			
Y1			

LC. REF. DES.	PIN NO. +5V	UL COM	GL +5V	▽ (-15V)
U1	—	—	14	7
U2	—	—	14	7
U3	—	—	16	8
U4	—	—	16	8
U5	—	—	16	8
U6	—	—	16	8
U7	—	—	16	8
U8	—	—	14	7
U10	—	—	14	7
U11	—	—	14	7
U12	—	—	14	7
U13	—	—	14	7
U14	—	—	14	7
U15	—	—	1,16	8
U16	—	—	16	8
U17	—	—	14	7
U18	—	—	14	7
U19	—	—	14	7
U20	—	—	14	7
U21	—	—	14	7
U22	—	—	14	7
U23	—	—	14	7
U24	—	—	14	4,7-11
U25	—	—	14	7
U26	—	—	14	7
U27	—	—	14	7
U28	—	—	16	8
U29	—	—	14	7
U30	—	—	1,16	8
U34	—	—	5	10
U35	—	—	14	7
U42	14	1,2,5-7	—	—
U43	14	7	—	—
U45	16	8,12,13,15	—	—
U46	14	7	—	—
U47	14	7	—	—
U48	14	1,2,7,8,13	—	—
U49	14	7	—	—
U50	1,16	8	—	—
U51	14	7	—	—
U53	16	8	—	—
U54	14	7	—	—

FIGURE 8-4. (1 of 2) GUARD CROSSING PCB ASSEMBLY (2200A–1004)


SEE SHEET 1
E
F
G
H
K
L
MUX1
MUX2
MUX3
MUX4
MUX5
B0
B1
B2
B3
GL +5V
R14 1K
R11 1K
A
B
R1 1K
U7
U6
(-15V)
U2C
U22D
U14A
U21A
U21C
U22B
U23A
U22A
U22C
U14B
U20A
U20
U19A
OPEN TC
P26-10
MUX 5
U8C
U10A
U8D
U8B
U8A
U25C
U13C
U21B
U18A
CM
P26-22
U13D
Y1
R12 2.2K
R13 2.2K
TP4
U26C
C9 .05
U26B
C8 100PF
U13B
U25A
U10B
FAST
P26-21
U12B
U27A
U34
U35B
U26D
U27C
U27B
U18B
U35A
TP5
TP6
U19B

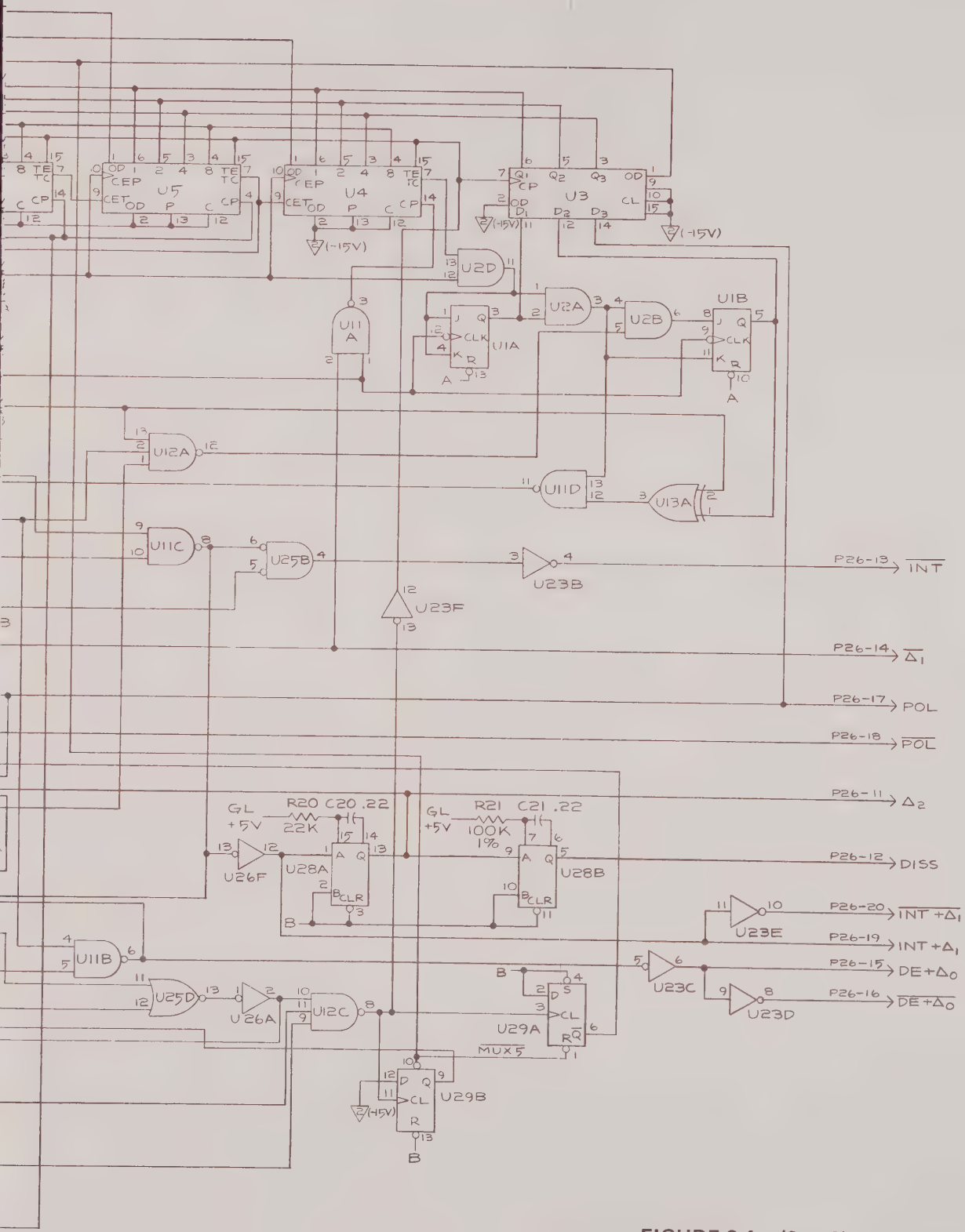
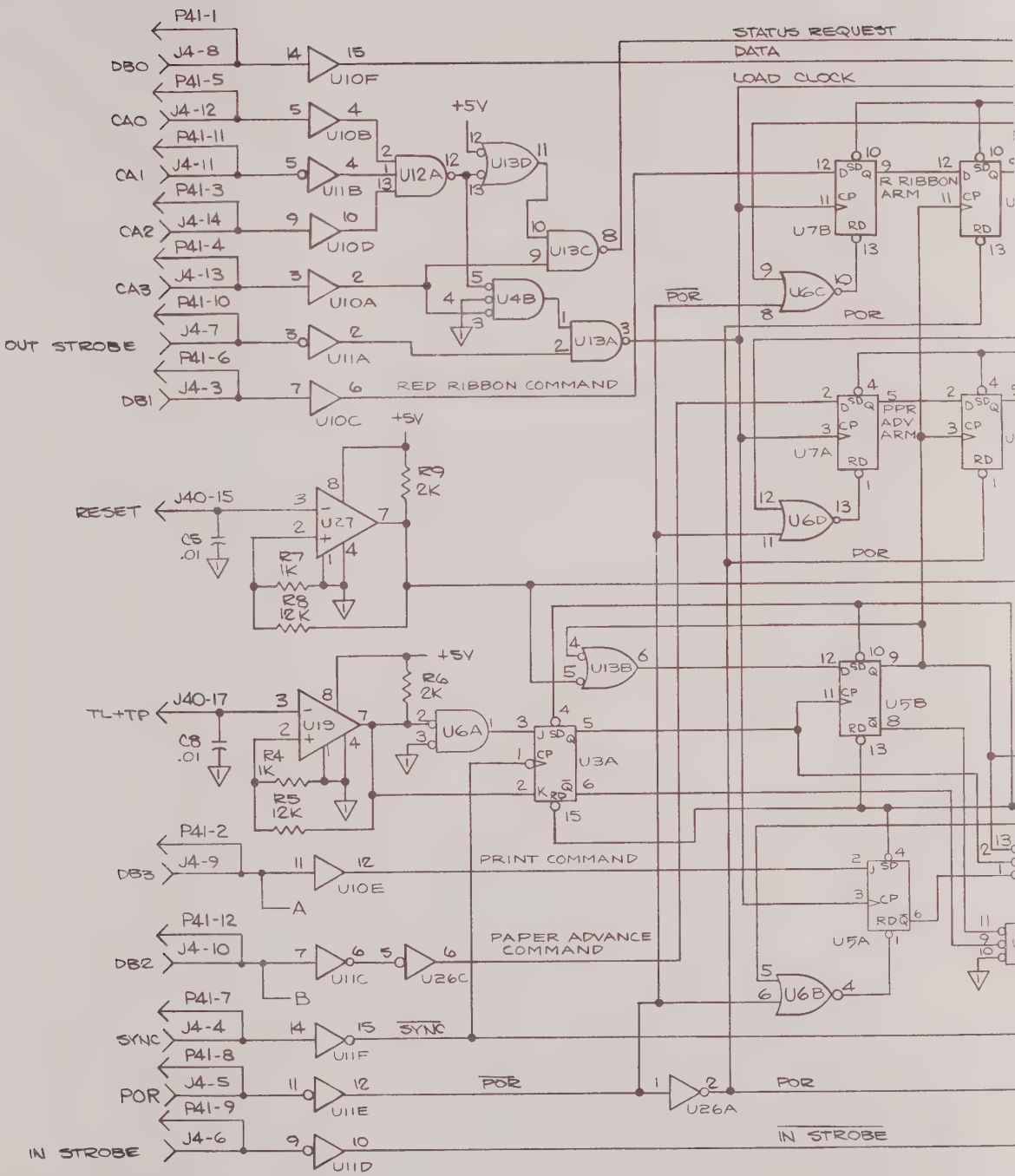


FIGURE 8-4. (2 of 2) GUARD CROSSING PCB ASSEMBLY (2200A–1004)



I.C. REF. DES.	PIN NO. +5V	PIN NO. UL COM	PIN NO. +16V RET
U1	14	7	—
U2	14	7	—
U3	16	8	—
U4	14	7	—
U5	14	7	—
U6	14	7	—
U7	14	7	—
U8	14	7	—
U9	14	7	—
U10	1,16	8	—
U11	1,16	8	—
U12	14	7	—
U13	14	7	—
U14	8	—	4

I.C. REF. DES.	PIN NO. +5V	PIN NO. UL COM	PIN NO. +16V RET
U15	8	—	4
U16	8	—	4
U17	8	—	4
U18	14	7	—
U19			
U20	8	—	4
U21	8	—	4
U22	8	—	4
U23	8	—	4
U24	8	—	4
U25	16	—	8
U26	14	—	7
U27			

REFERENCE DESIGNATIONS	
LAST USED	NOT USED
C14	
Q1	
R9	
U27	

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ▽ DENOTES UNGUARDED LOGIC COMMON (UL COM).
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.2. AND Y 32.14.
5. FOR ASSY. DWG. SEE 2200A-4007. FO REF. DES. DWG. SEE 2200A-1607.

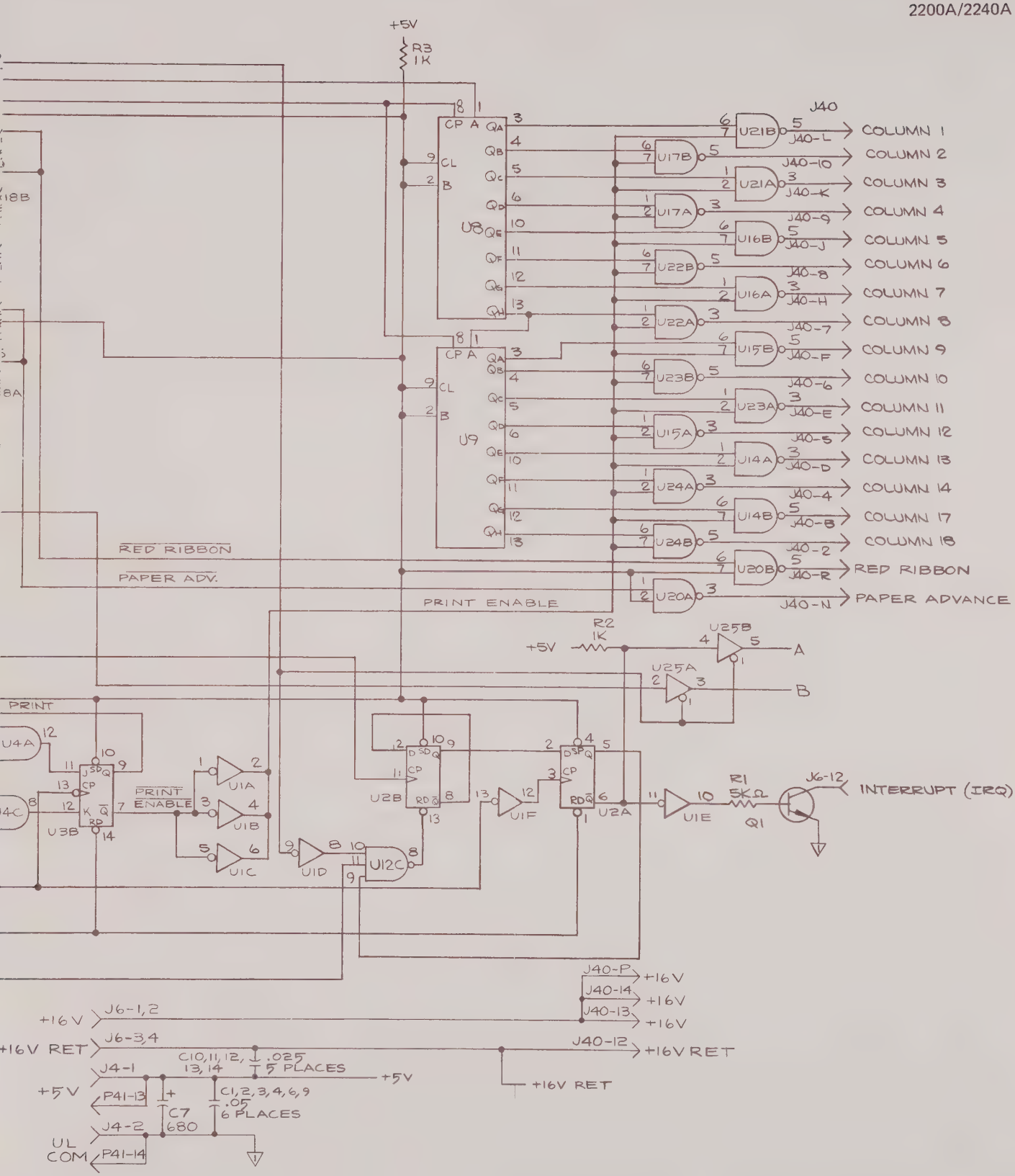
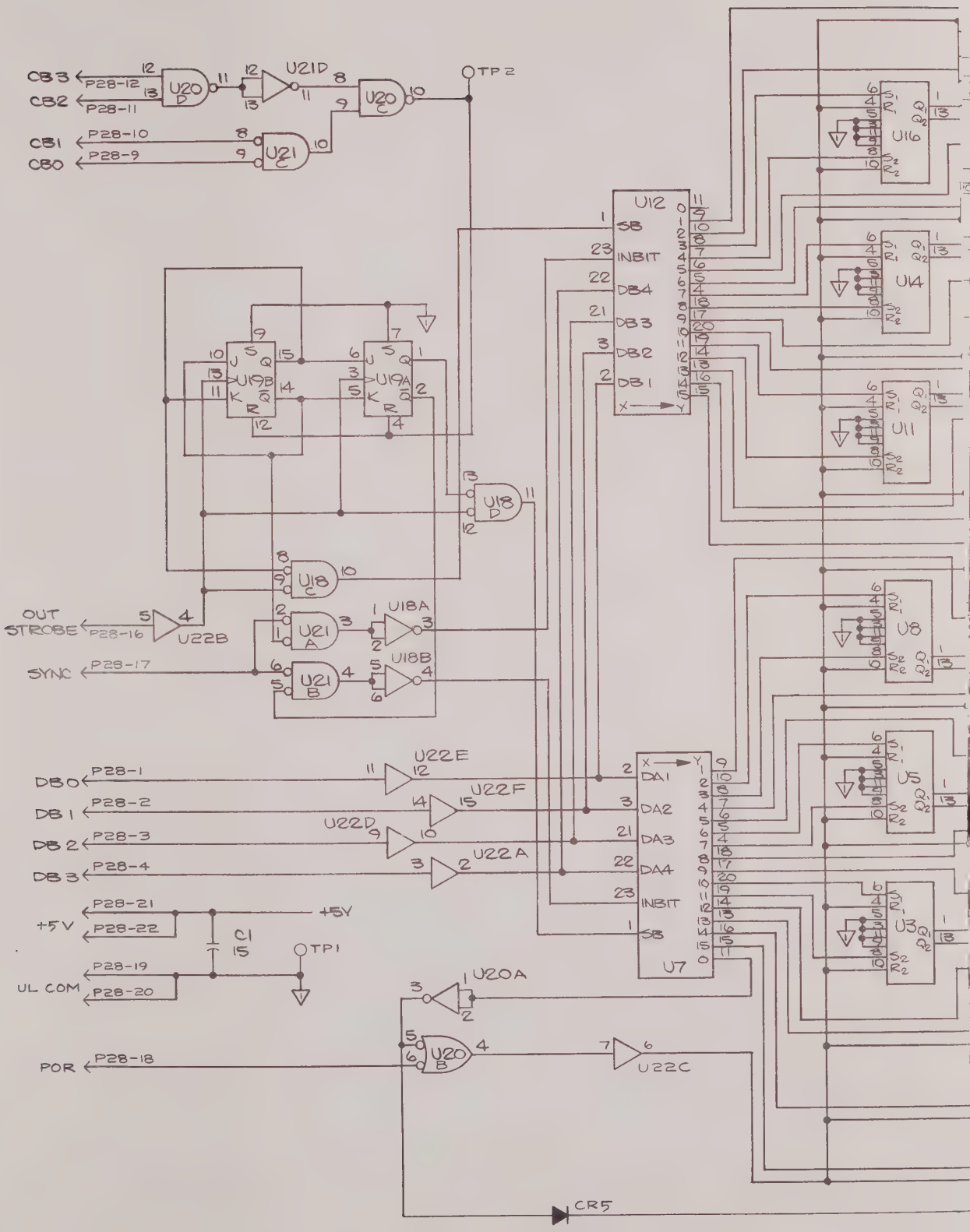
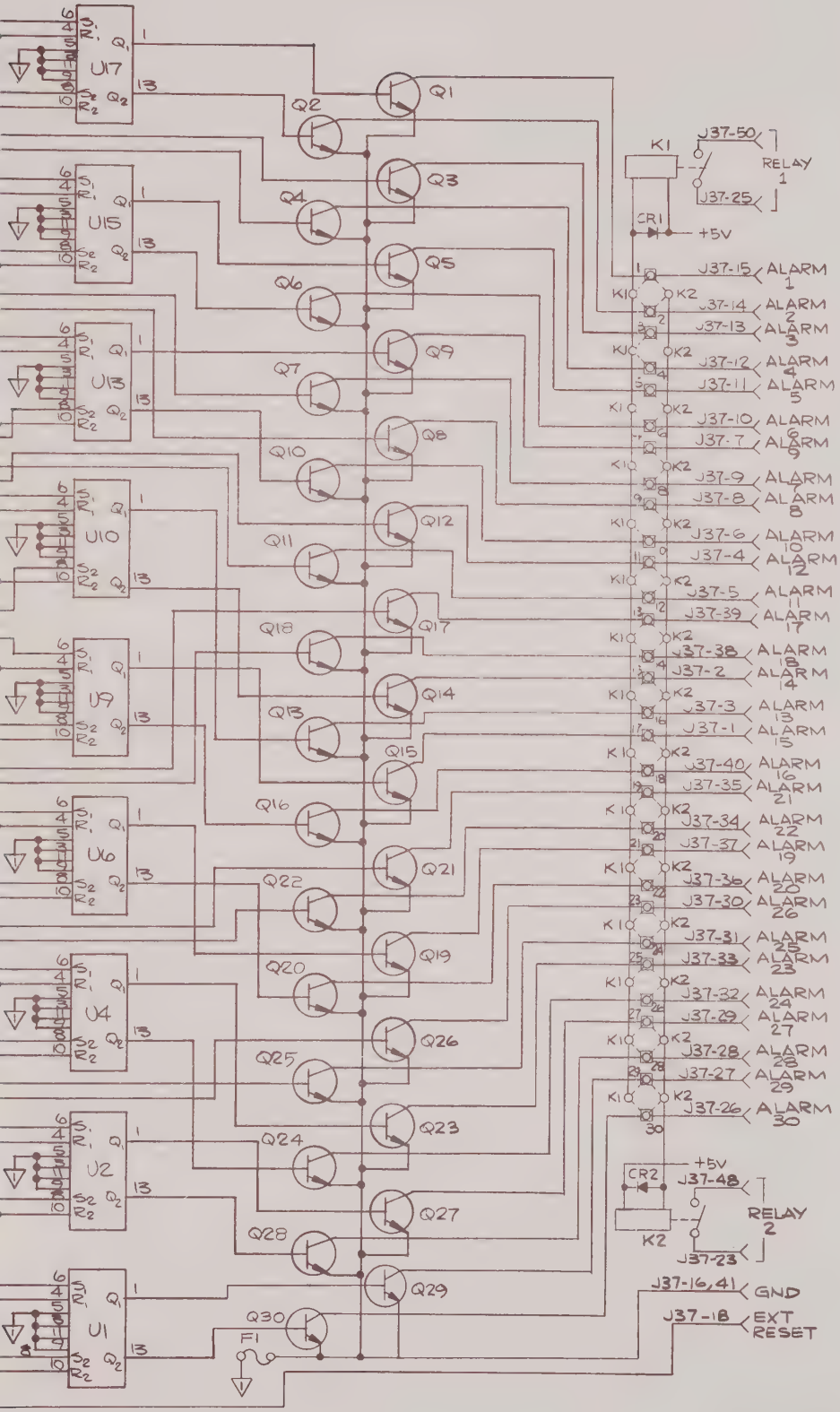


FIGURE 8-5. PRINTER DRIVE PCB ASSEMBLY (2200A–1007)


CB3
CB2
CB1
CB0
P28-12
P28-11
P28-10
P28-9
U20
U21
TP2
U12
INBIT
DB4
DB3
DB2
DB1
U19
U18
U16
U14
U11
U8
U5
U3
U7
OUT STROBE
P28-16
U22B
SYNC
P28-17
U18A
U18B
DB0
DB1
DB2
DB3
P28-1
P28-2
P28-3
P28-4
U22E
U22F
U22D
U22A
DA1
DA2
DA3
DA4
+5V
P28-21
P28-22
C1
TP1
UL COM
P28-19
P28-20
POR
P28-18
U20A
U22C
CR5



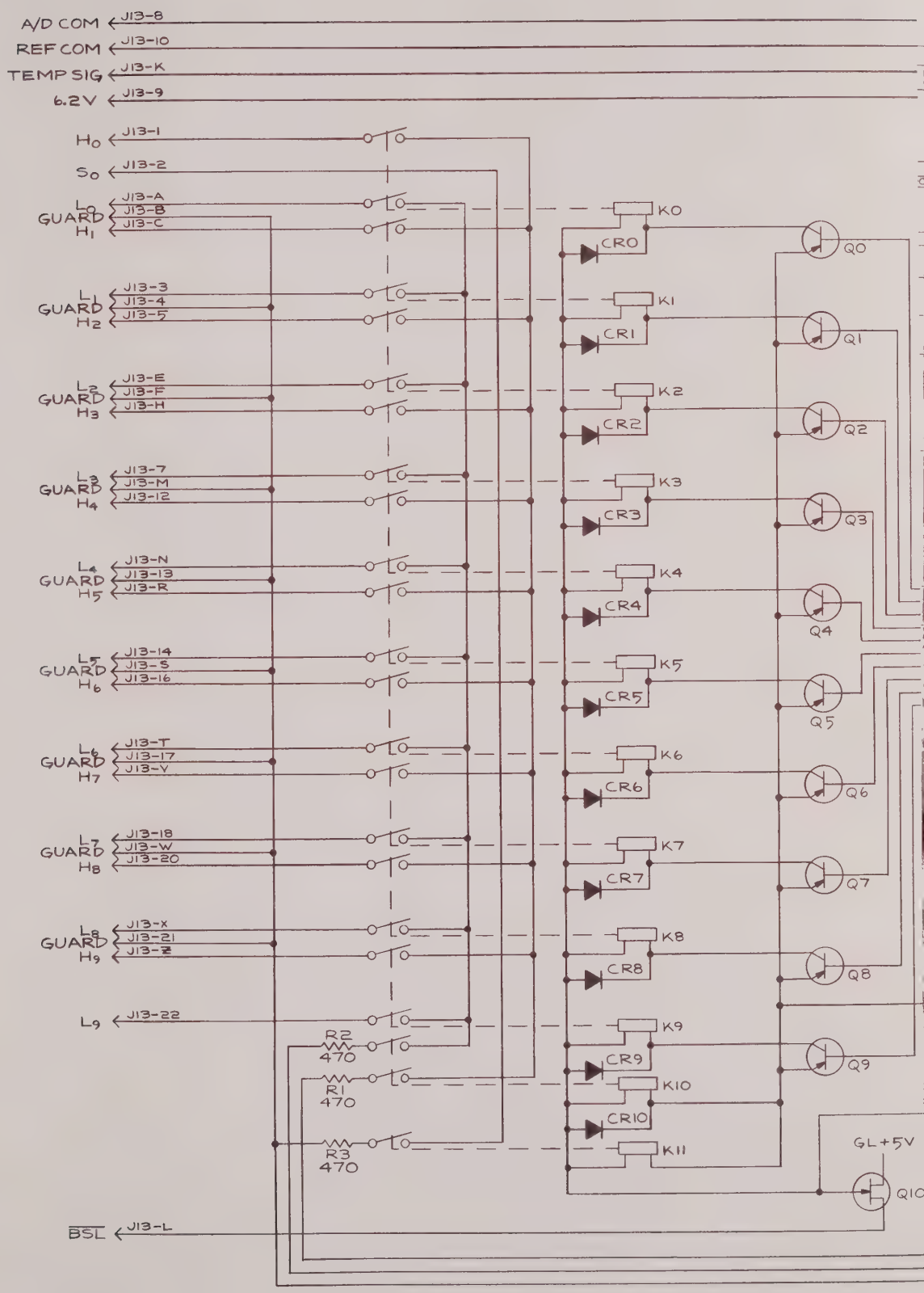
NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL CAPACITANCES ARE IN MICROFARADS.
2. ALL GRAPHIC SYMBOLS ARE IN ACCORDANCE WITH ANSI Y32.2 & Y32.14.
3. ▽ DENOTES UNGUARDED LOGIC COMMON (UL COM)
4. FOR ASSY DWG SEE 2200A-4031
5. FOR REF. DES. DWG SEE 2200A-1631.

REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
C1 CR5 K2 Q30 U22		CR3,4	

I.C. REF. DES.	PIN NO.	
	+5V	UL COM
U1	14	7
U2	14	7
U3	14	7
U4	14	7
U5	14	7
U6	14	7
U7	16	8
U8	14	7
U9	14	7
U10	14	7
U11	14	7
U12	16	8
U13	14	7
U14	14	7
U15	14	7
U16	14	7
U17	14	7
U18	14	7
U19	16	8
U20	14	7
U21	14	7
U22	1,16	8

FIGURE 8-6. ALARM OUTPUT PCB ASSEMBLY OPTION –23 (2240A–1031)

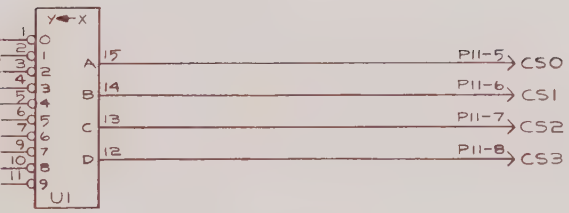

A/D COM
J13-8
REF COM
J13-10
TEMP SIG
J13-K
6.2V
J13-9
H0
J13-1
S0
J13-2
L0
GUARD
H1
J13-A
J13-B
J13-C
L1
GUARD
H2
J13-3
J13-4
J13-5
L2
GUARD
H3
J13-E
J13-F
J13-H
L3
GUARD
H4
J13-7
J13-M
J13-12
L4
GUARD
H5
J13-N
J13-13
J13-R
L5
GUARD
H6
J13-14
J13-5
J13-16
L6
GUARD
H7
J13-T
J13-17
J13-V
L7
GUARD
H8
J13-18
J13-W
J13-20
L8
GUARD
H9
J13-X
J13-21
J13-Z
L9
J13-22
R2
470
R1
470
R3
470
BSL
J13-L
K0
CR0
Q0
K1
CR1
Q1
K2
CR2
Q2
K3
CR3
Q3
K4
CR4
Q4
K5
CR5
Q5
K6
CR6
Q6
K7
CR7
Q7
K8
CR8
Q8
K9
CR9
Q9
K10
CR10
K11
GL+5V
Q10

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ▽(-15V) DENOTES GUARDED LOGIC COMMON [GL COM(-15V)] WHICH IS -15V WITH RESPECT TO A/D COM.
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.14 AND Y32.2.
5. FOR ASSY. DWG. SEE 2200A-4006. FOR REF. DES. DWG SEE 2200A-1609.
6. ALL VOLTAGES NOTED ARE WITH RESPECT TO A/D COM.

I.C. REF. DES.	PIN NO.	
	GL+5V	GL COM
U1	16	8

REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
CR10 K11 Q13 R5	U1	Q11	



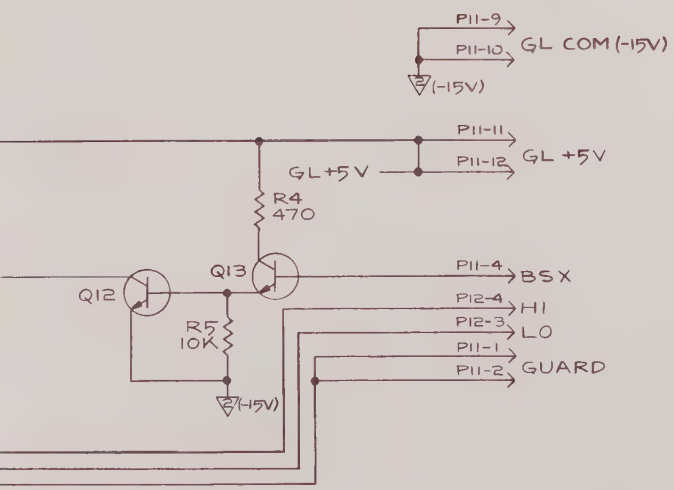
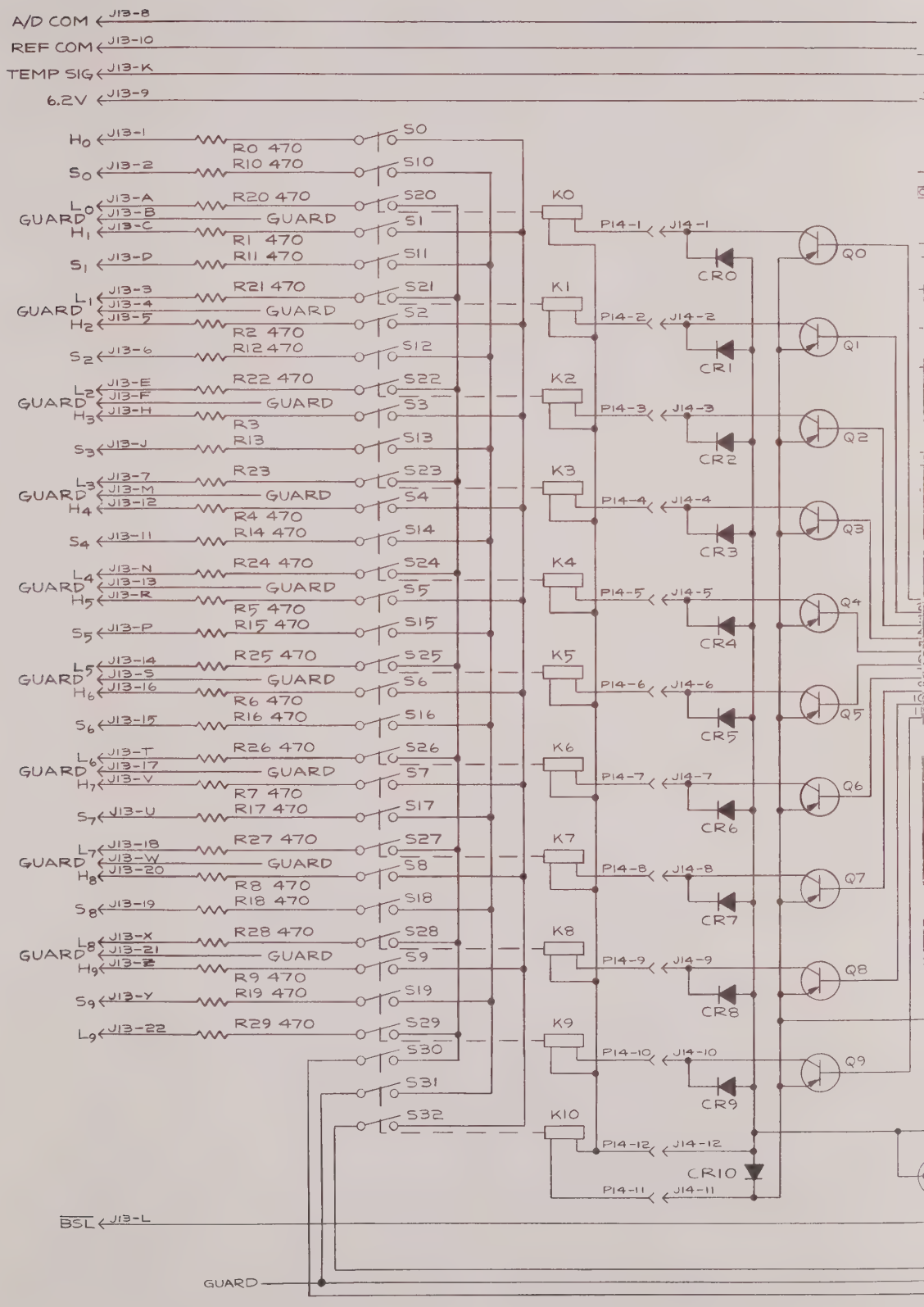


FIGURE 8-7. GENERAL PURPOSE SCANNER PCB ASSEMBLY, OPTION –05 (2200A–1006)


A/D COM J13-8
REF COM J13-10
TEMP SIG J13-K
6.2V J13-9
H0 J13-1
S0 J13-2
L0 J13-A
GUARD J13-B
H1 J13-C
S1 J13-D
L1 J13-3
GUARD J13-4
H2 J13-5
S2 J13-6
L2 J13-E
GUARD J13-F
H3 J13-H
S3 J13-J
L3 J13-7
GUARD J13-M
H4 J13-12
S4 J13-11
L4 J13-N
GUARD J13-13
H5 J13-R
S5 J13-P
L5 J13-14
GUARD J13-S
H6 J13-16
S6 J13-15
L6 J13-T
GUARD J13-17
H7 J13-V
S7 J13-U
L7 J13-18
GUARD J13-W
H8 J13-20
S8 J13-19
L8 J13-X
GUARD J13-21
H9 J13-Z
S9 J13-Y
L9 J13-22
R0 470
R10 470
R20 470
GUARD
R1 470
R11 470
R21 470
GUARD
R2 470
R12 470
R22 470
GUARD
R3
R13
R23
GUARD
R4 470
R14 470
R24 470
GUARD
R5 470
R15 470
R25 470
GUARD
R6 470
R16 470
R26 470
GUARD
R7 470
R17 470
R27 470
GUARD
R8 470
R18 470
R28 470
GUARD
R9 470
R19 470
R29 470
S0
S10
S20
S1
S11
S21
S2
S12
S22
S3
S13
S23
S4
S14
S24
S5
S15
S25
S6
S16
S26
S7
S17
S27
S8
S18
S28
S9
S19
S29
S30
S31
S32
K0
K1
K2
K3
K4
K5
K6
K7
K8
K9
K10
P14-1 J14-1
P14-2 J14-2
P14-3 J14-3
P14-4 J14-4
P14-5 J14-5
P14-6 J14-6
P14-7 J14-7
P14-8 J14-8
P14-9 J14-9
P14-10 J14-10
P14-12 J14-12
P14-11 J14-11
CR0
CR1
CR2
CR3
CR4
CR5
CR6
CR7
CR8
CR9
CR10
Q0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
BSL J13-L
GUARD

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ⬡ DENOTES CALIBRATION ADJ POINTS. ALL POINTS ARE SCREWDRIVER ADJUST.
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.2. AND Y32.14.
5. ▽(-15V) DENOTES GUARDED LOGIC COMMON [GL COM (-15V)] WHICH IS -15V WITH RESPECT TO A/D COM.
6. FOR ASSY. DWG. SEE 2200A-4029. FOR REF. DES. DWG. SEE 2200A-1629.
7. ALL VOLTAGES NOTED ARE WITH RESPECT TO A/D COM.

I.C. REF DES.	PIN NO.	
	GL +5V	GL COM
U1	16	8

REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
CR10 K10 Q12 R34	S32 U1	R30-32	

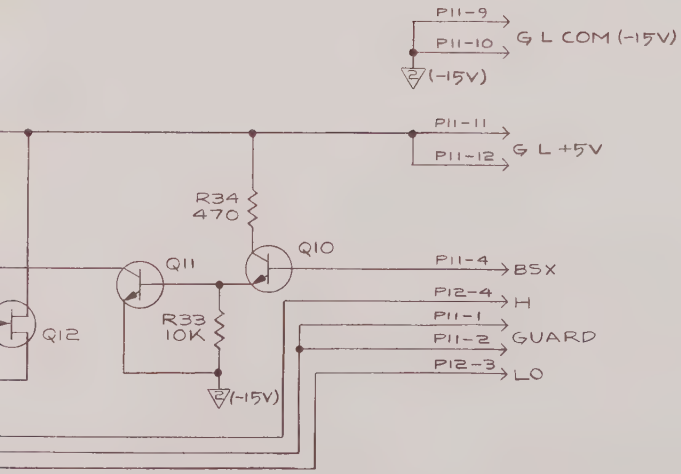


FIGURE 8-8. LOW LEVEL SCANNER PCB ASSEMBLY, OPTION –06 (2200A–1029)

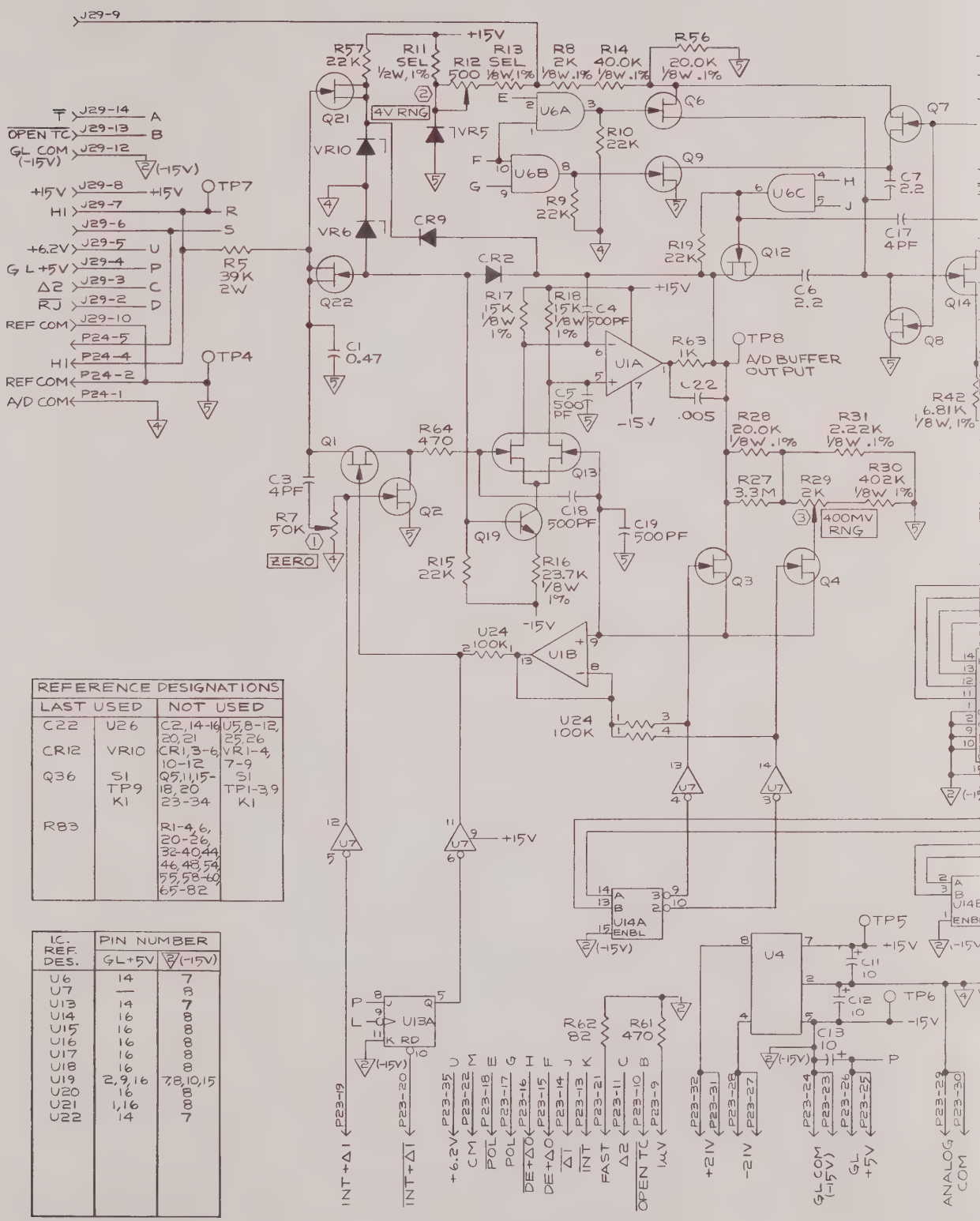
NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ⬡ DENOTES CALIBRATION ADJ POINTS. ALL POINTS ARE SCREWDRIVER ADJUST.
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.2.
5. FOR ASSY. DWG. SEE 2200A-4023.
6. R4 IS FACTORY SELECTED AND IS ONE OF THE LISTED VALUES:
   OPEN 100K
   287K 76.8K
   147K

A	1
B	2
C	3
D	4
E	5
F	6
H	7
J	8
K	9
L	10
M	11
N	12
P	13
R	14
S	15
T	16
U	17
V	18
W	19
X	20
Y	21
Z	22

REAR VIEW OF P13

FIGURE 8-9. ISOTHERMAL BLOCK CONNECTOR ASSEMBLY, OPTION –08 (2200A–1023)



REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
C22	U26	C2, 14-16, 20, 21	U5, 8-12, 25, 26
CR12	VR10	CR1, 3-6, 10-12	VR1-4, 7-9
Q36	S1	Q5, 11, 15-18, 20, 23-34	S1
	TP9		TP1-3, 9
	K1		K1
R83		R1-4, 6, 20-26, 32-40, 44, 46, 48, 54, 55, 58-60, 65-82	

IC. REF. DES.	PIN NUMBER	
	GL+5V	(-15V)
U6	14	7
U7	—	8
U13	14	7
U14	16	8
U15	16	8
U16	16	8
U17	16	8
U18	16	8
U19	2, 9, 16	7, 8, 10, 15
U20	16	8
U21	1, 16	8
U22	14	7

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ⬡ DENOTES CALIBRATION ADJ POINTS. ALL POINTS ARE SCREWDRIVER ADJUST.
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.2.
5. ▽2 (-15V) DENOTES GUARDED LOGIC COMMON [GL COM (-15V)] WHICH IS -15V WITH RESPECT TO A/D COM.
6. ▽4 DENOTES A/D COMMON (A/D COM.).
7. ▽5 DENOTES REFERENCE COMMON (REF. COM.).
8. FOR ASSY. DWG. SEE 2200A-4005. FOR REF. DES. DWG. SEE 2200A-1605.
9. ALL VOLTAGES NOTED ARE WITH RESPECT TO A/D COM.

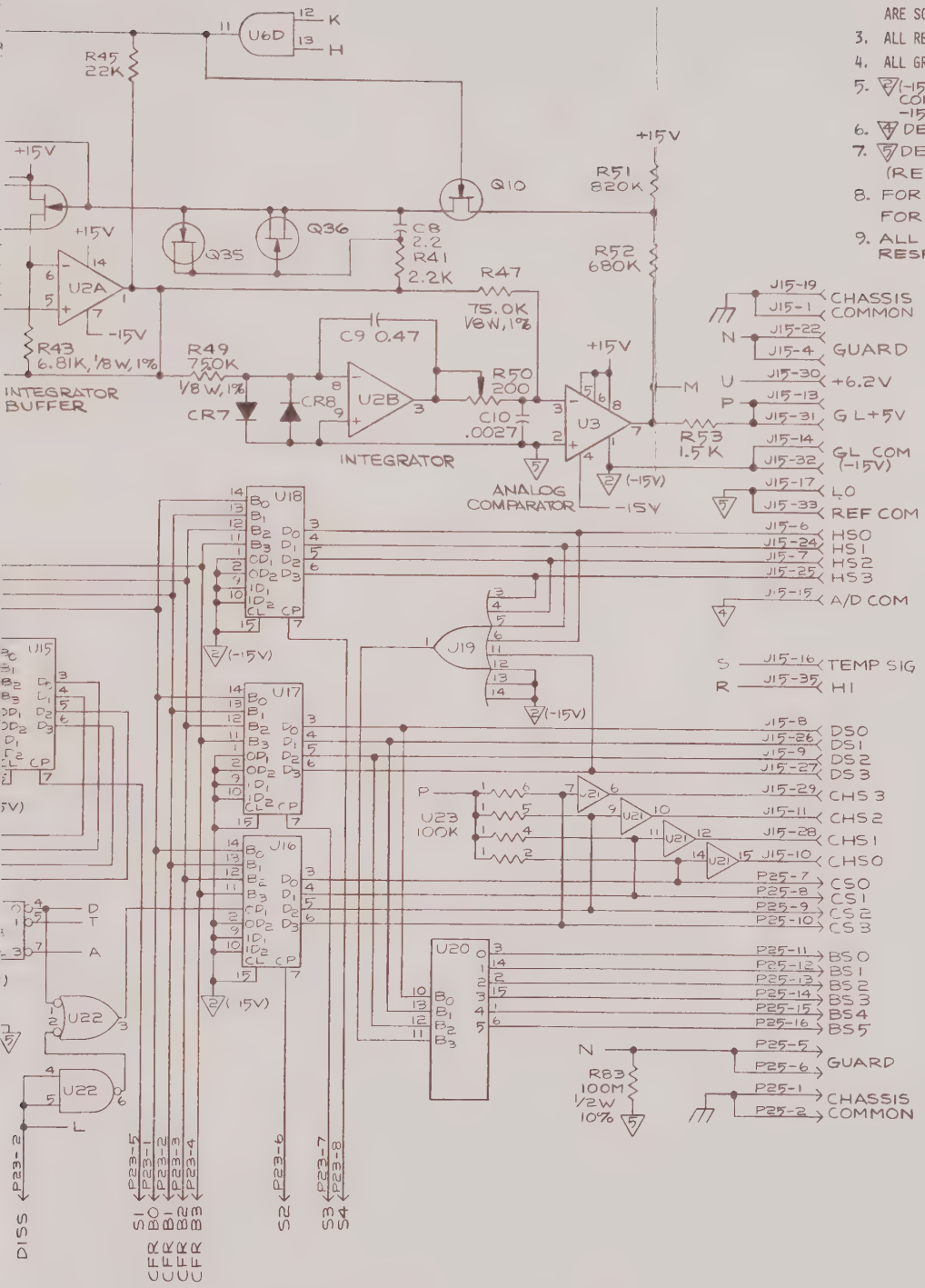
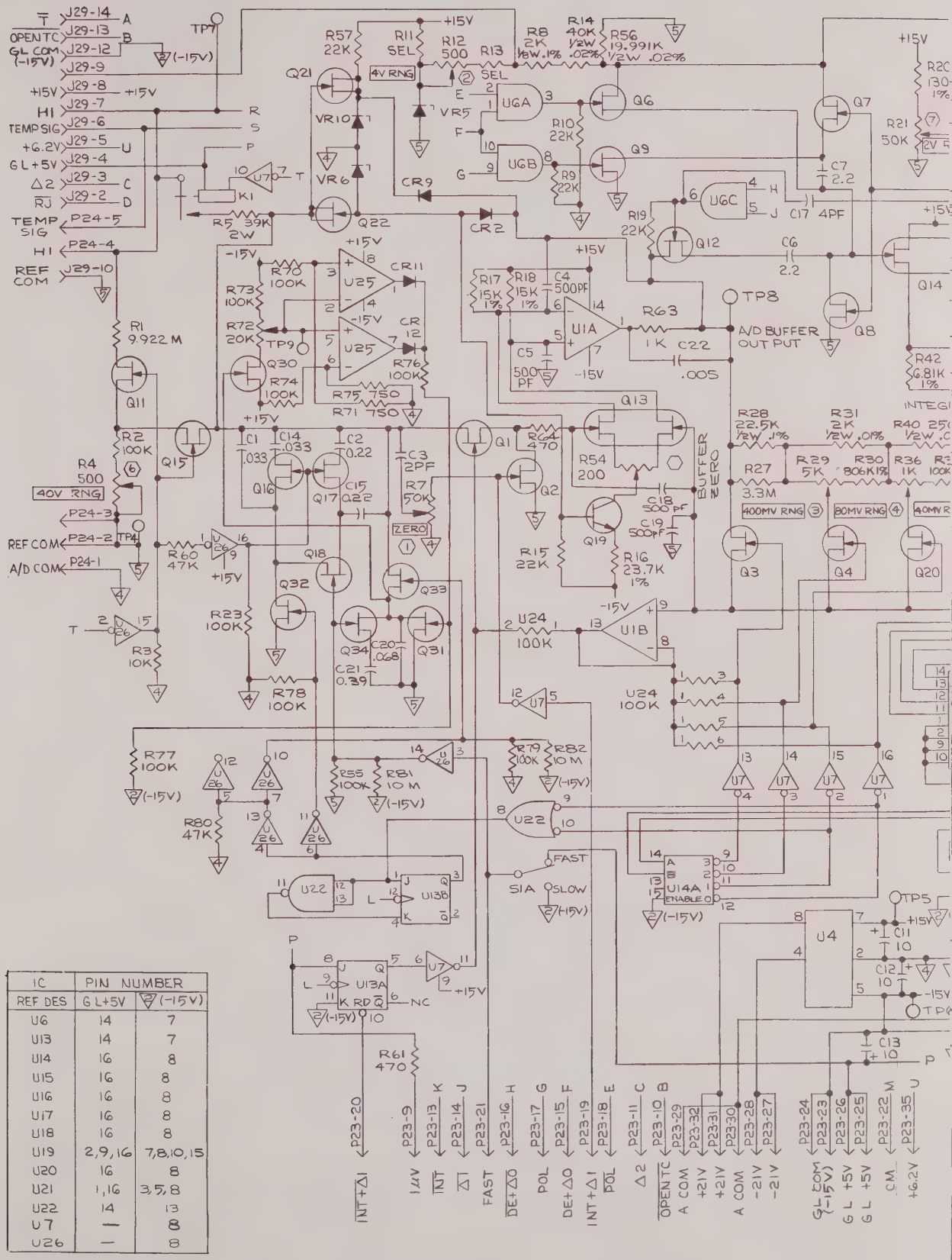
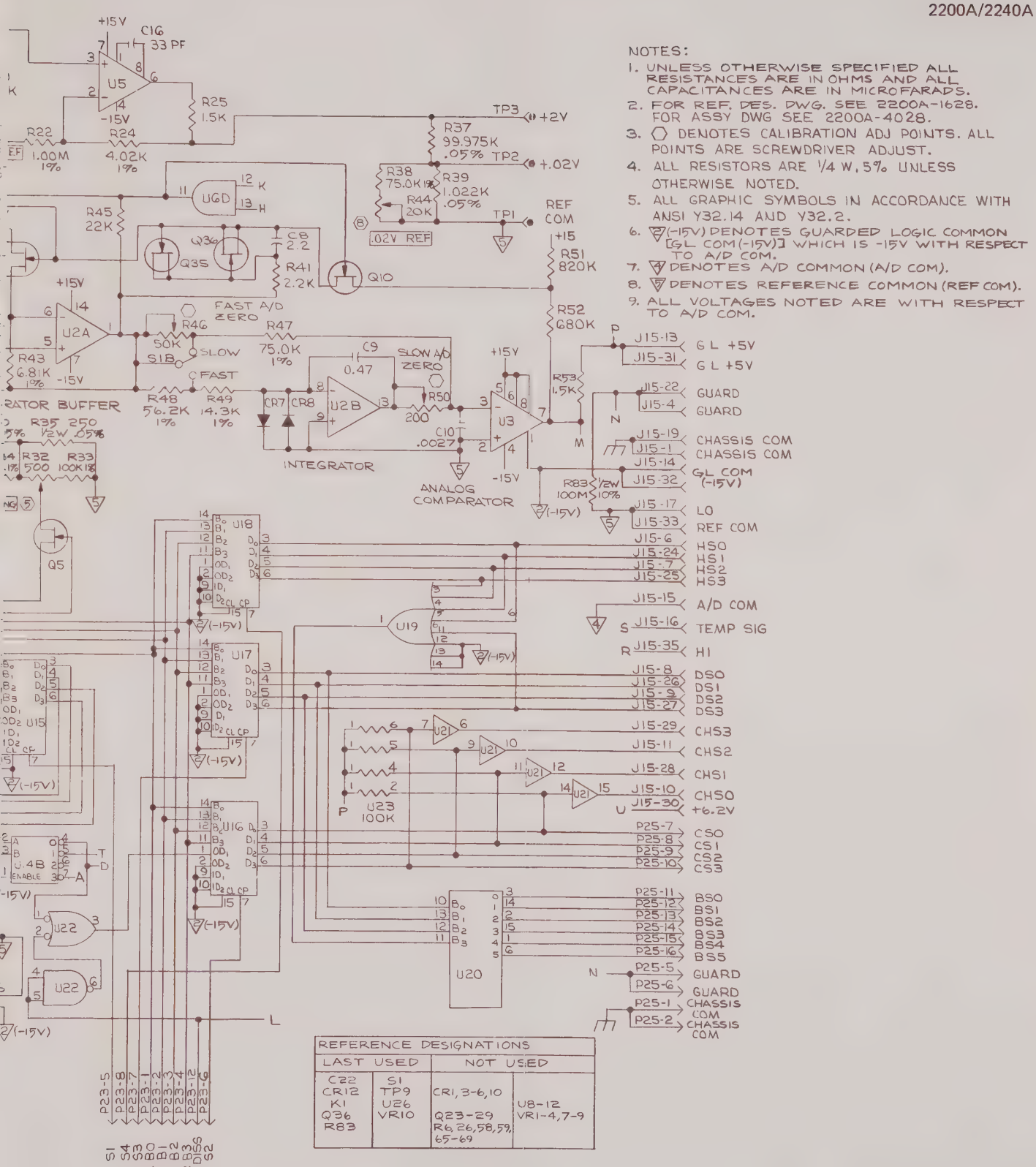


FIGURE 8-10. GENERAL PURPOSE A/D CONVERTER PCB ASSEMBLY, OPTION –09 (2200A–1005)

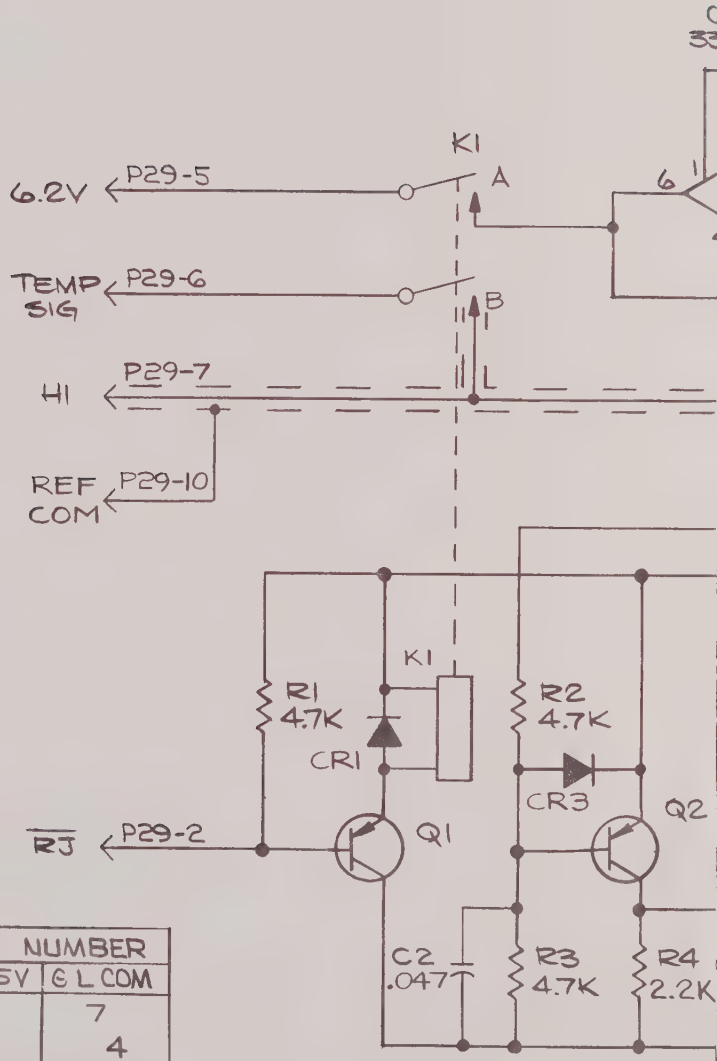


IC	PIN NUMBER	
REF DES	G L+5V	(-15V)
U6	14	7
U13	14	7
U14	16	8
U15	16	8
U16	16	8
U17	16	8
U18	16	8
U19	2,9,16	7,8,10,15
U20	16	8
U21	1,16	3,5,8
U22	14	13
U7	—	8
U26	—	8



REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
C22 CR12 K1 Q36 R83	S1 TP9 U26 VR10	CR1, 3-6, 10 Q23-29 R6, 26, 58, 59, 65-69	U8-12 VR1-4, 7-9

FIGURE 8-11. HIGH PERFORMANCE A/D CONVERTER PCB ASSEMBLY, OPTION –10 (2200A–1028)



IC	PIN NUMBER	
REF DES	G L +5V	G L COM
U1	14	7
U2	—	4

REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
C2 CR2 K2 Q3 R4 U2			

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ▽ DENOTES GUARDED LOGIC COMMON (GL COM)
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.14 AND Y32.2.

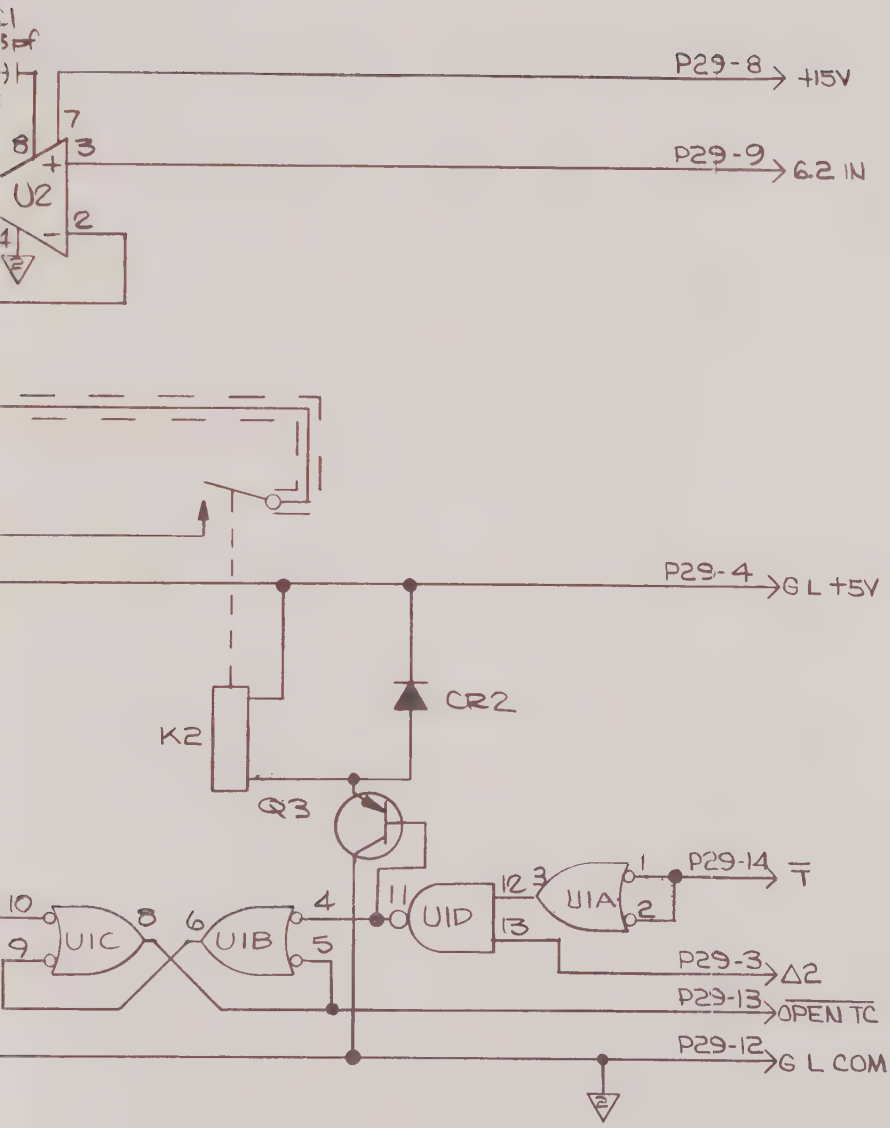
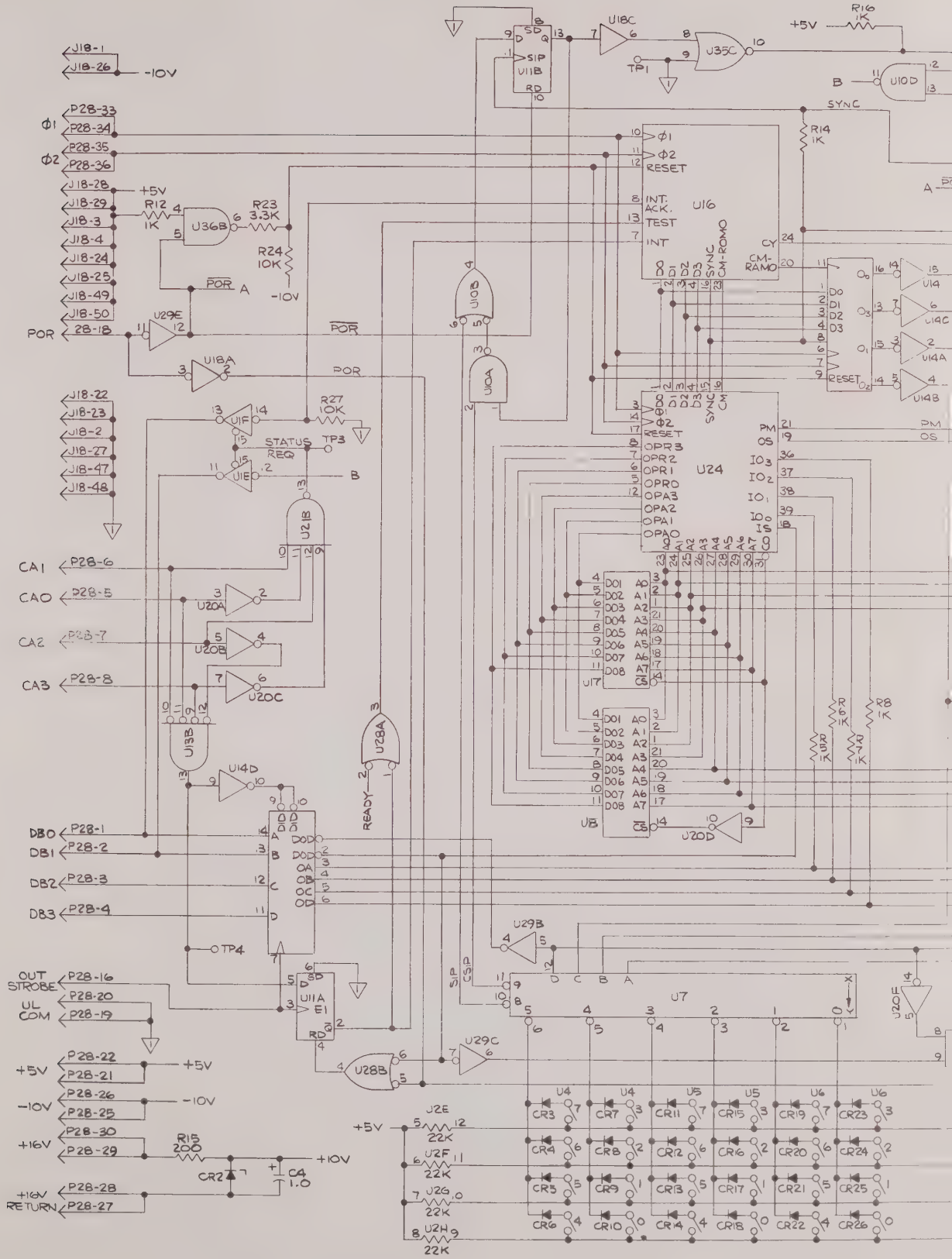
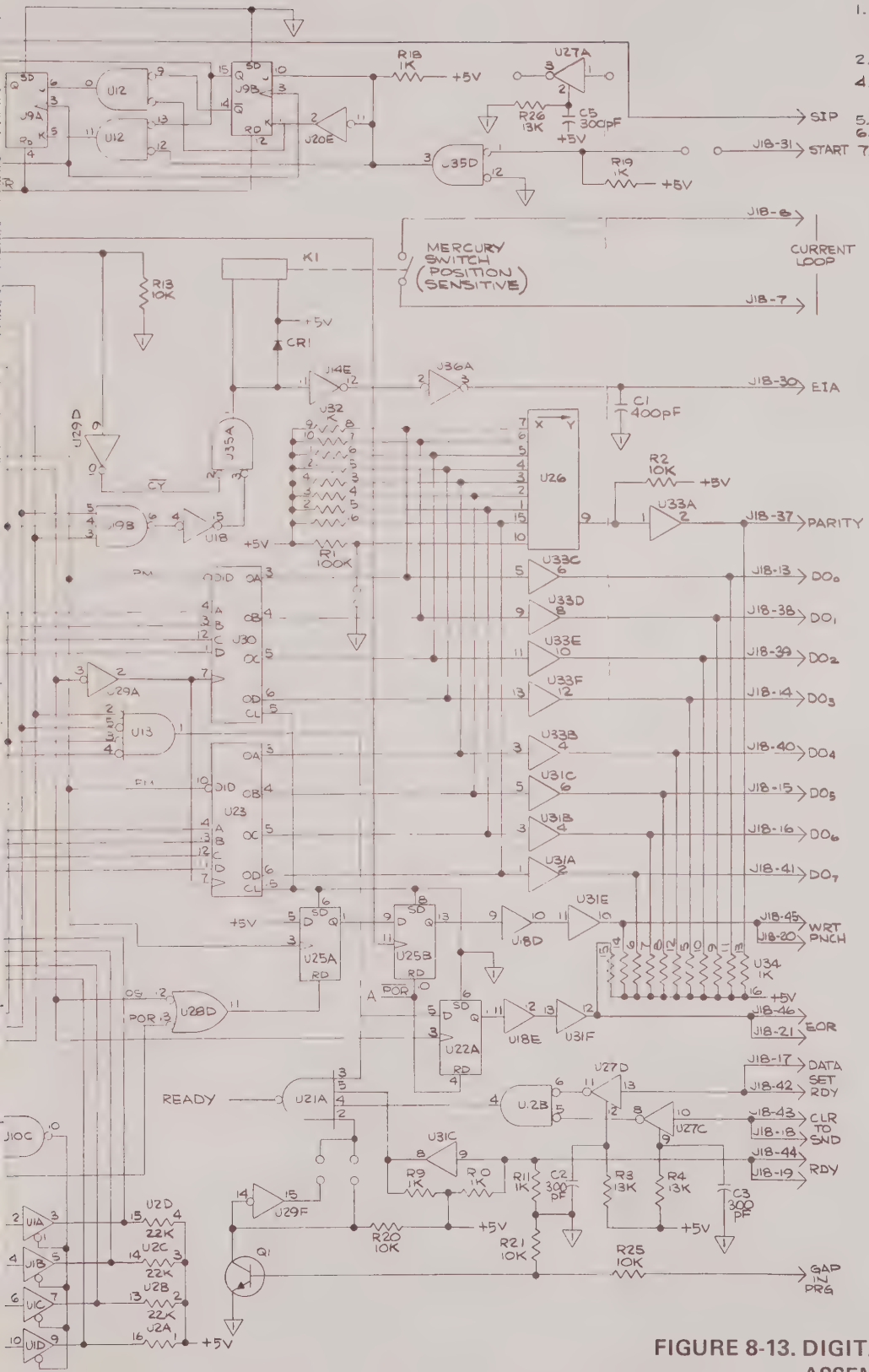


FIGURE 8-12. TEMPERATURE MEASUREMENT SYSTEM PCB ASSEMBLY, OPTION –11 (2200A–1021)

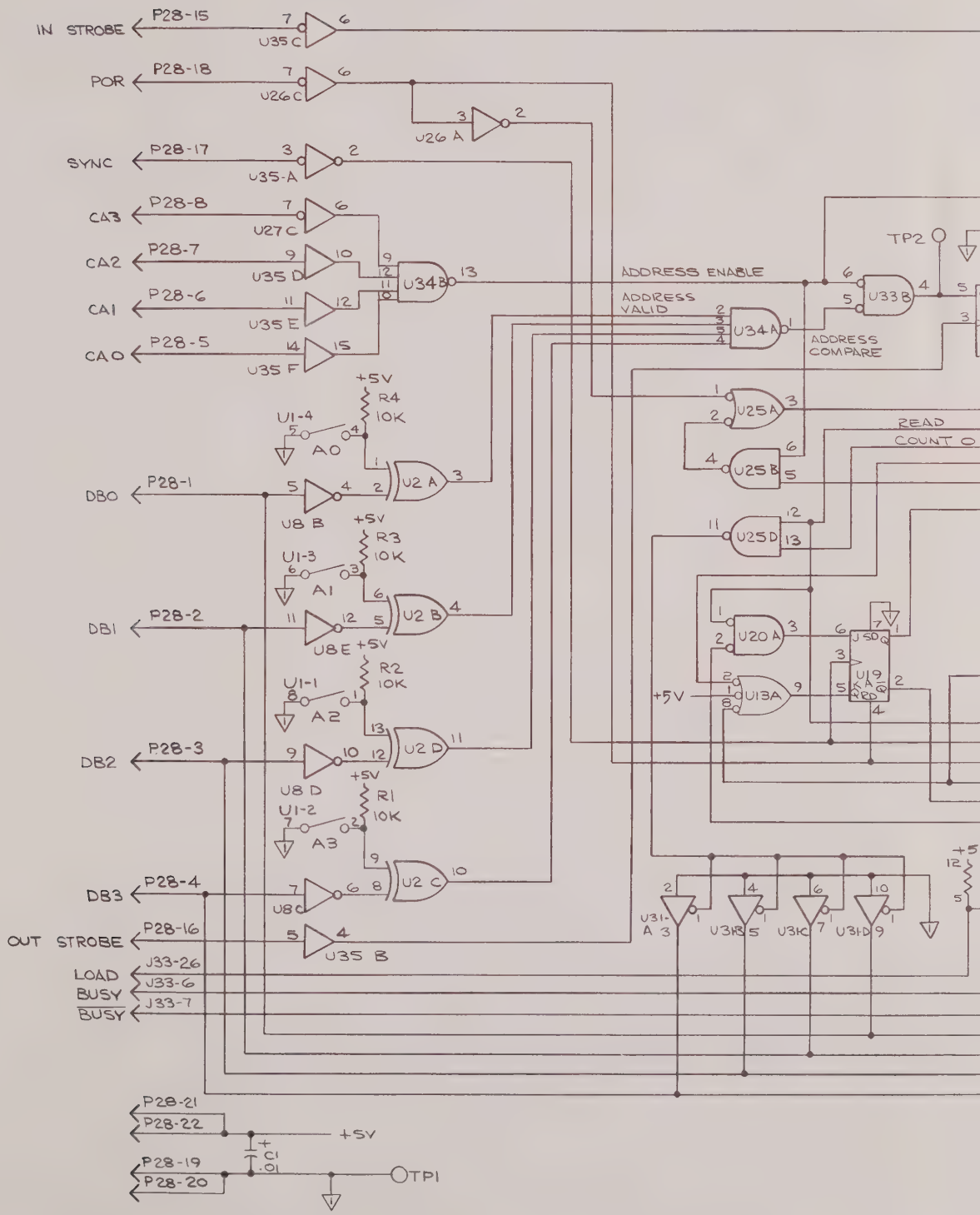

J18-1
J18-26
-10V
Φ1
Φ2
P28-33
P28-34
P28-35
P28-36
J18-28
J18-29
J18-3
J18-4
J18-24
J18-25
J18-49
J18-50
+5V
R12 1K
U36B
R23 3.3K
R24 10K
-10V
POR A
POR
P28-18
U29E
U18A
U10B
U10A
U18C
U35C
U11B
TP1
R16 1K
U10D
SYNC
R14 1K
U16
INT. ACK.
TEST
INT
CY
CM-RAMO
U14
U14C
U14A
U14B
J18-22
J18-23
J18-2
J18-27
J18-47
J18-48
U1F
U1E
R27 10K
STATUS REQ
TP3
B
U21B
CA1
CA0
CA2
CA3
P28-6
P28-5
P28-7
P28-8
U20A
U20B
U20C
U13B
U14D
U28A
READY
U24
OPR3
OPR2
OPR1
OPR0
OPA3
OPA2
OPA1
OPA0
PM
OS
U17
U8
U20D
R7 1K
R8 1K
DB0
DB1
DB2
DB3
P28-1
P28-2
P28-3
P28-4
TP4
U11A
OUT STROBE
UL COM
P28-16
P28-20
P28-19
U28B
U29C
U29B
SIP CSIP
U7
U20E
+5V
-10V
+16V
+16V RETURN
P28-22
P28-21
P28-26
P28-25
P28-30
P28-29
P28-28
P28-27
R15 200
CR27
C4 1.0
+10V
J2E 22K
J2F 22K
J2G 22K
J2H 22K
CR3
CR7
CR11
CR15
CR19
CR23
CR4
CR8
CR12
CR16
CR20
CR24
CR5
CR9
CR13
CR17
CR21
CR25
CR6
CR10
CR14
CR18
CR22
CR26



REFERENCE DESIGNATIONS	
LAST USED	NOT USED
U37 R27 C5 CR2	U3

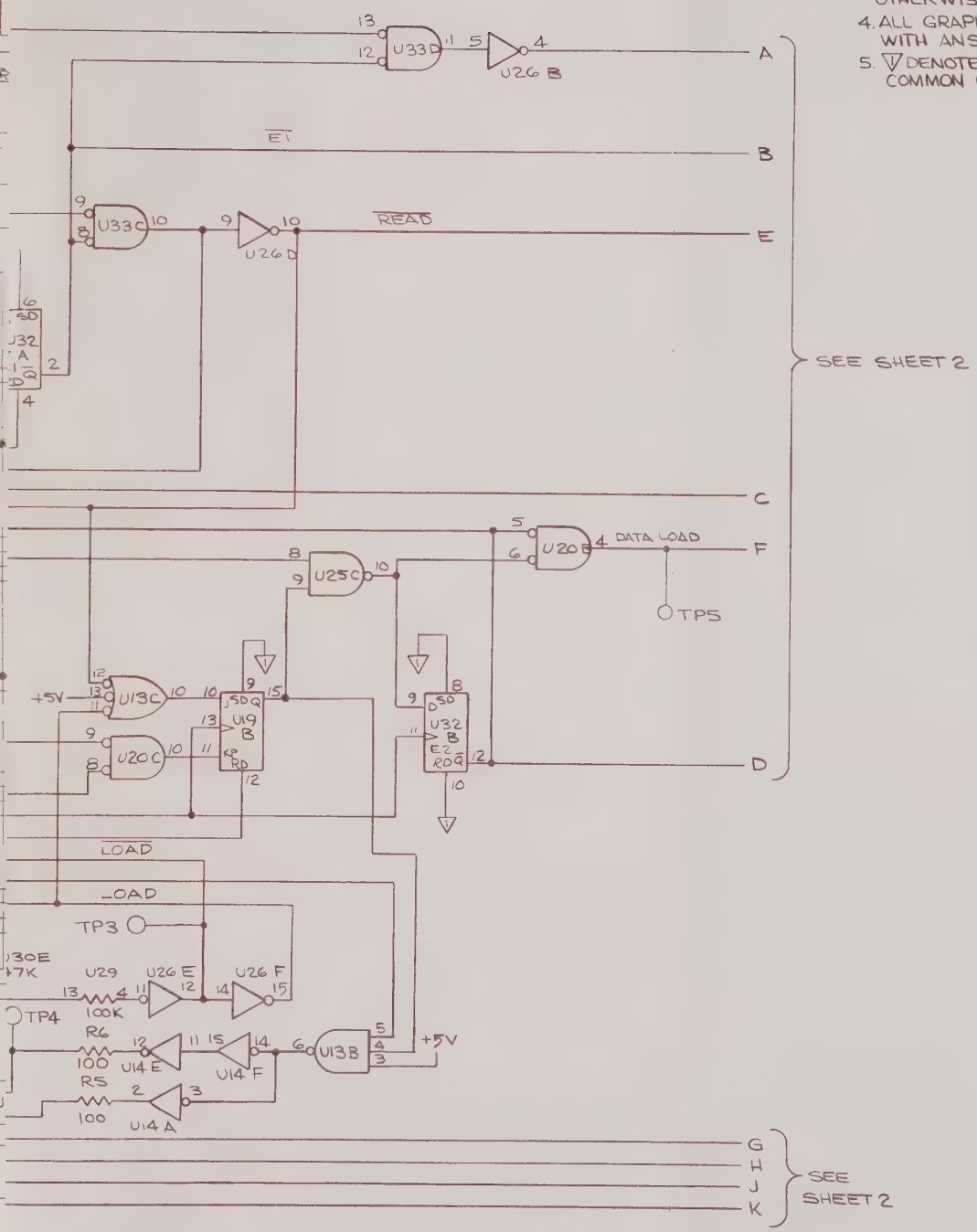
IC REF DES	PIN NUMBER +5V	+10V	-10V	UL COM
U1	16			8
U2	16			
U4				
U5				
U6				
U7	6			8
U8	12,13,15,22,23		16,24	
U9	16			8
U10	14			7
U11	14			7,8
U12	14,1			7
U13	14			7
U14	1,16			8
U15	5		12	
U16	6,9		14,15,21	
U17	12,13,15,22,23		16,24	
U18	1,16			8
U19	14			7
U20	1,16			8
U21	14			7
U22	14			7
U23	16		1,2,9,8	
U24	20		40	35
U25	14			7
U26	16		8,11,12,13,14	
U27	14			7
U28	14			7
U29	1,16			8
U30	16		1,2,9,8	
U31	14			7
U32				
U33	14			7
U34				
U35	16			8
U36		14		7
U37	16		1	8

FIGURE 8-13. DIGITAL OUTPUT INTERFACE PCB ASSEMBLY, (2200A–1014)


IN STROBE
P28-15
U35 C
POR
P28-18
U26 C
U26 A
SYNC
P28-17
U35-A
CA3
P28-8
U27 C
CA2
P28-7
U35 D
CA1
P28-6
U35 E
CA0
P28-5
U35 F
U34B
ADDRESS ENABLE
ADDRESS VALID
U34A
U33B
TP2
ADDRESS COMPARE
+5V
R4
10K
U1-4
A0
U2 A
DB0
P28-1
U8 B
R3
U1-3
A1
U2 B
DB1
P28-2
U8E
R2
U1-1
A2
U2 D
DB2
P28-3
U8 D
R1
U1-2
A3
U2 C
DB3
P28-4
U8C
OUT STROBE
P28-16
U35 B
LOAD
BUSY
J33-26
U33-6
J33-7
U25A
U25B
U25D
READ
COUNT
U20 A
U13A
U19
U31-A
U31-B
U31-C
U31-D
P28-21
P28-22
P28-19
P28-20
C1
.01
TP1

NOTES:

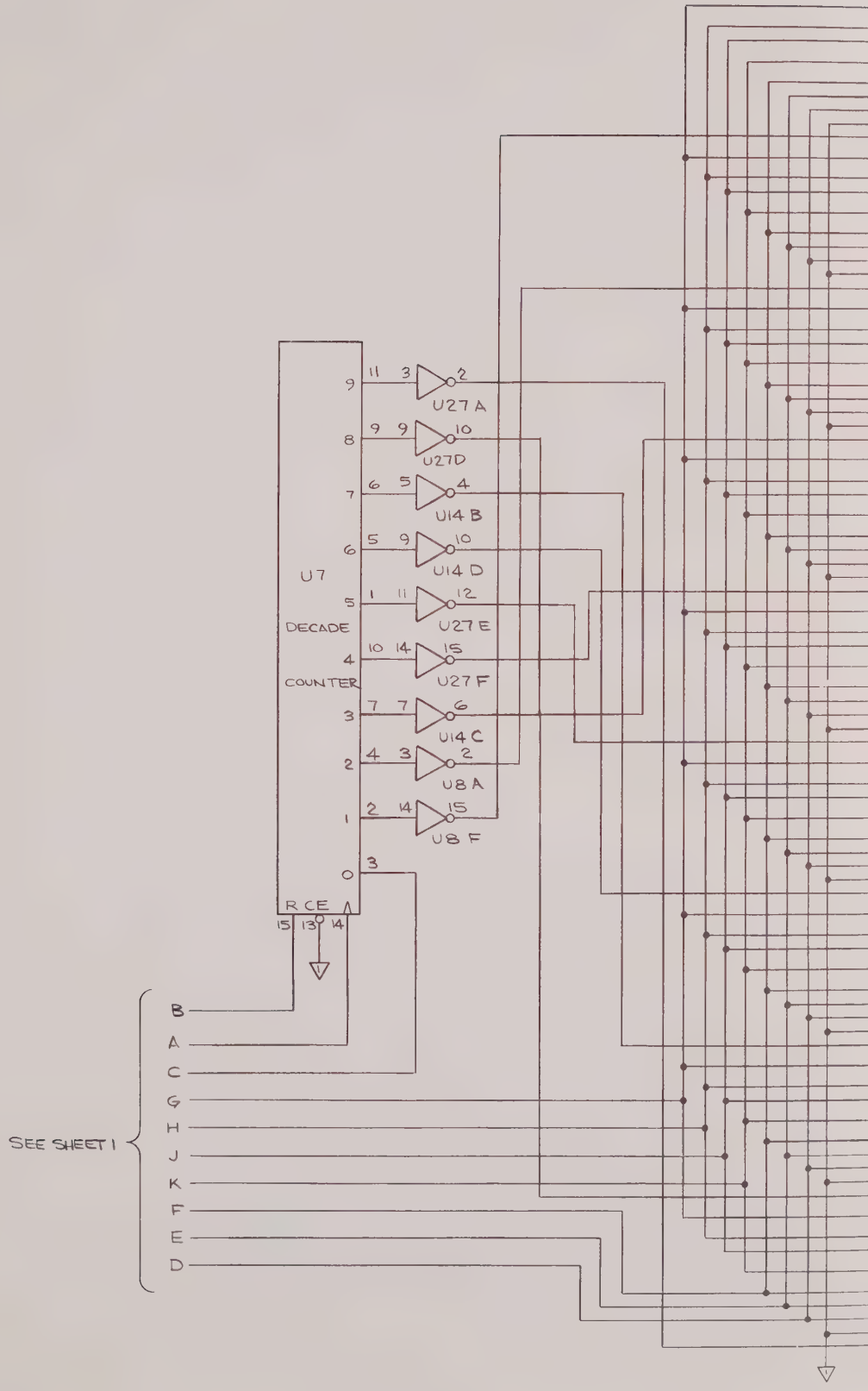
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. FOR ASSY DWG SEE 2200A-4017.
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.14 AND Y32.2.
5. ▽ DENOTES UNGUARDED LOGIC COMMON (UL COM).



IC REF DES	PIN NO +5V	PIN NO UL COM	IC REF DES	PIN NO +5V	PIN NO UL COM
U1	—	13-16	U19	16	7,8,9
U2	14	7	U20	12,13,14	7
U3	16	8,9,15	U21	16	8,9,15
U4	16	8,9,15	U22	16	8,9,15
U5	—	—	U23	—	—
U6	9-16	—	U24	1-4,9-12	—
U7	16	8,13	U25	14	7
U8	16,1	8	U26	1,16	8
U9	16	8,9,15	U27	1,16	4,8
U10	16	8,9,15	U28	16	8,9,15
U11	—	—	U29	—	—
U12	1-4,9-12	—	U30	12-16	—
U13	1,3,13,14	7	U31	15,16	2,4,6,8,10
U14	16,1	8	U32	14	7,8,10
U15	16	8,9,15	U33	1,2,14	7
U16	16	8,9,15	U34	14	7
U17	—	—	U35	1,16	8
U18	1-4,9-12	—			

REFERENCE DESIGNATION		
LAST USED	NOT USED	
R6		
C1		
U35		
TP5		

FIGURE 8-14. (1 of 2) DIGITAL INPUT PCB ASSEMBLY, OPTION –16 (2200A–1017)


U7
DECADE
COUNTER
R CE
15 13 14
9
8
7
6
5
4
3
2
1
0
11 3 2
U27 A
9 9 10
U27D
6 5 4
U14 B
5 9 10
U14 D
1 11 12
U27 E
10 14 15
U27 F
7 7 6
U14 C
4 3 2
U8 A
2 14 15
U8 F
3
B
A
C
G
H
J
K
F
E
D
SEE SHEET 1

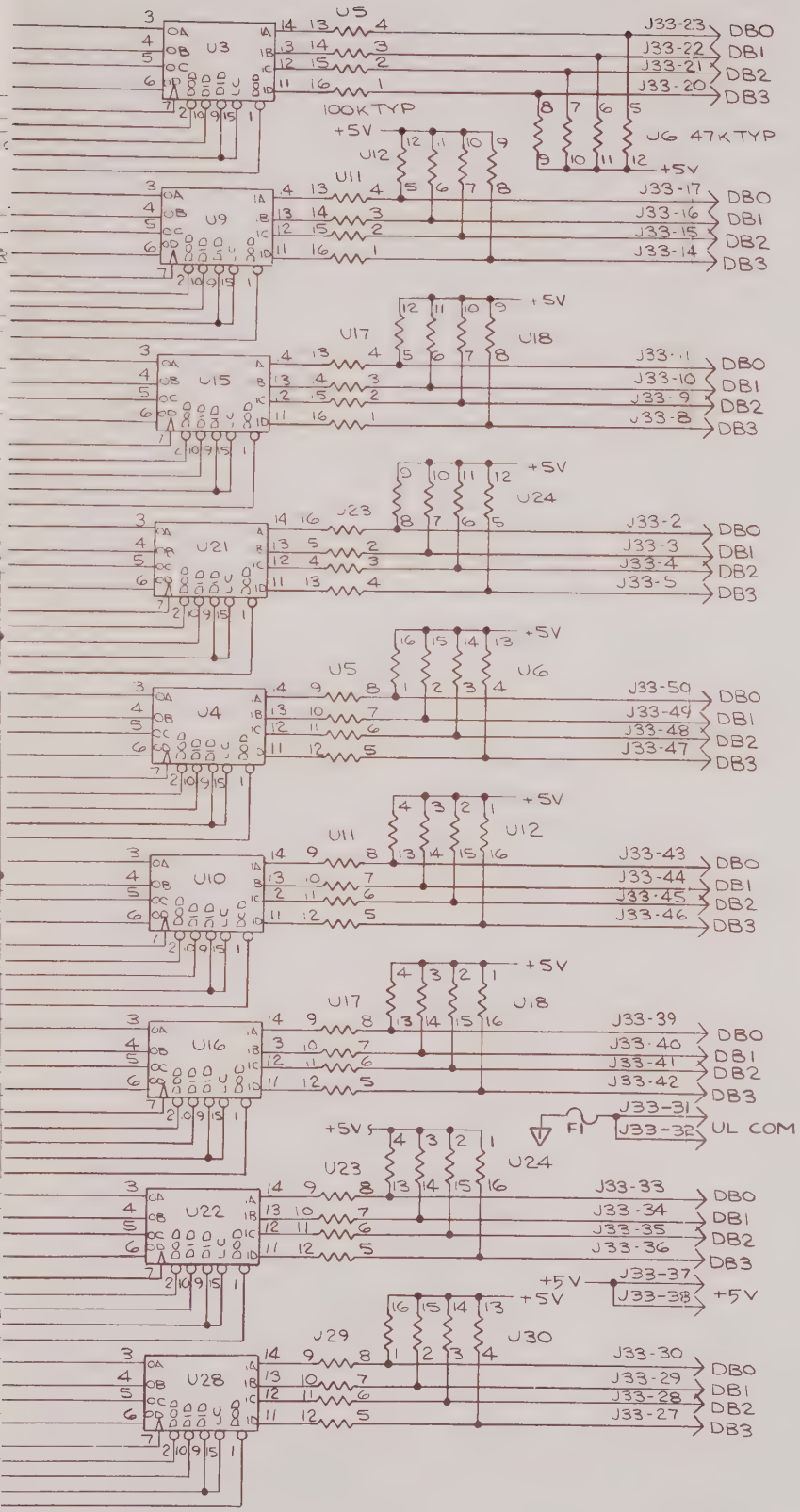
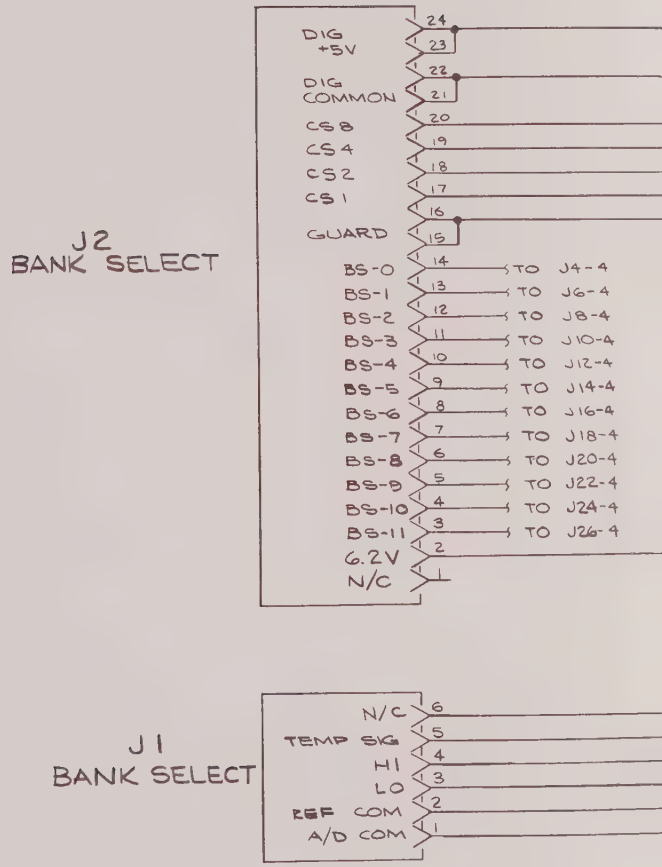


FIGURE 8-14. (2 of 2) DIGITAL INPUT PCB ASSEMBLY, OPTION – 16 (2200A–1017)


J2
BANK SELECT
DIG +5V
DIG COMMON
CS8
CS4
CS2
CS1
GUARD
BS-0
BS-1
BS-2
BS-3
BS-4
BS-5
BS-6
BS-7
BS-8
BS-9
BS-10
BS-11
6.2V
N/C
TO J4-4
TO J6-4
TO J8-4
TO J10-4
TO J12-4
TO J14-4
TO J16-4
TO J18-4
TO J20-4
TO J22-4
TO J24-4
TO J26-4

J1
BANK SELECT
N/C
TEMP SNS
HI
LO
REF COM
A/D COM

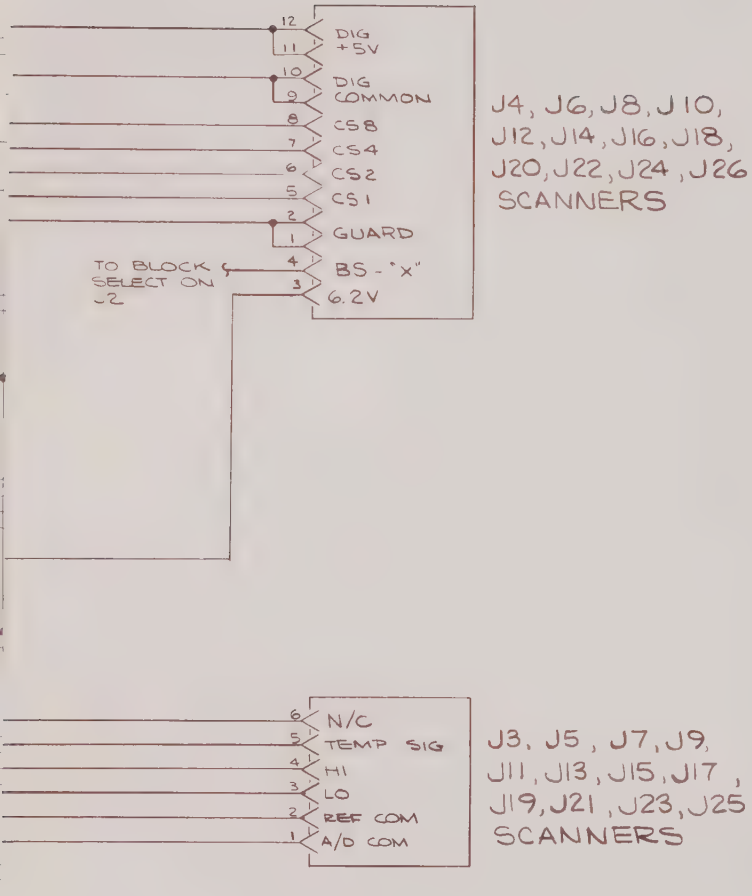
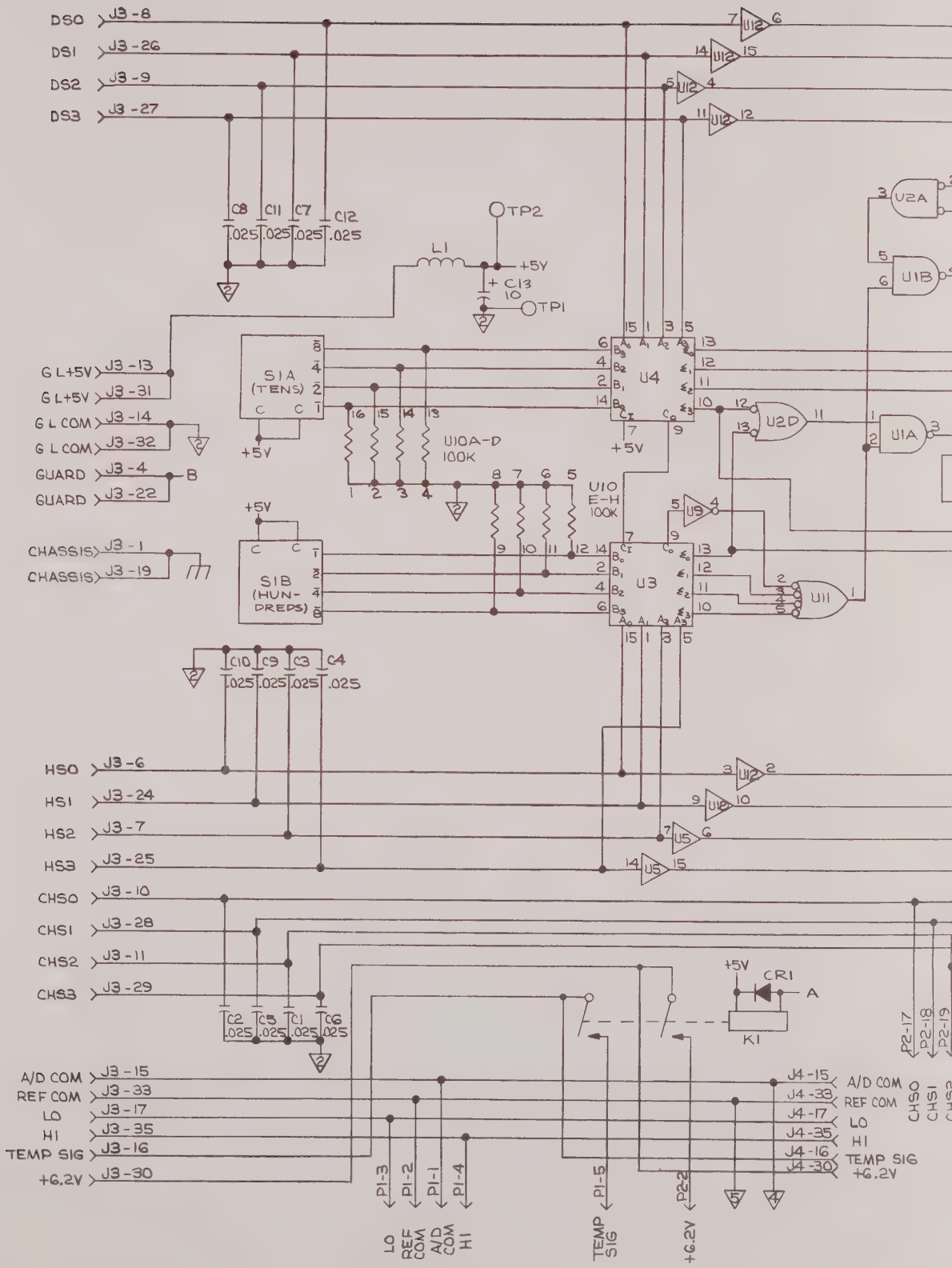
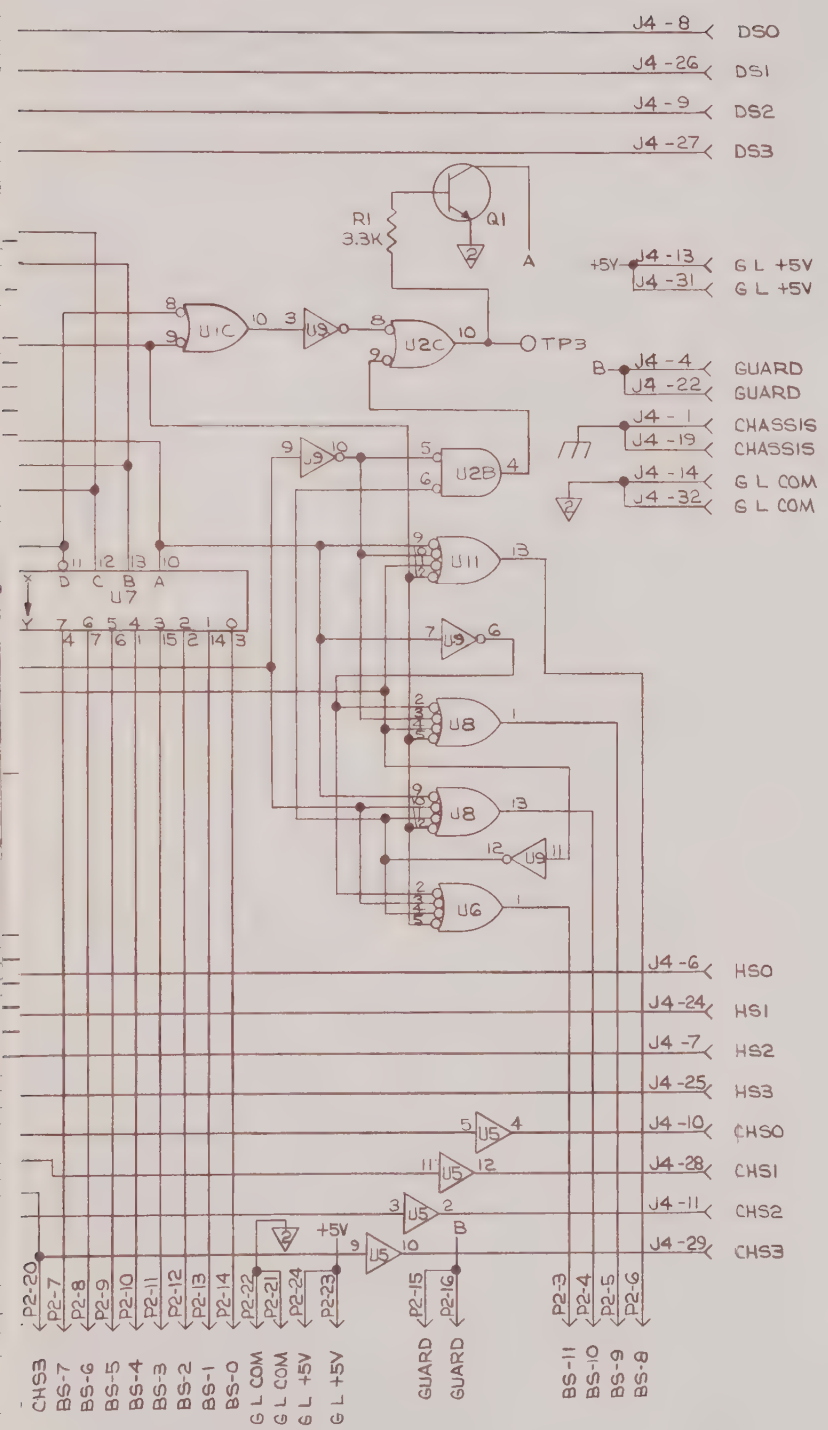


FIGURE 8-15. SCANNER EXTENDER MOTHER BOARD PCB ASSEMBLY (2201A–1001)


DS0 J3-8
DS1 J3-26
DS2 J3-9
DS3 J3-27
C8 .025
C11 .025
C7 .025
C12 .025
L1
TP2
+5V
+ C13 10
TP1
G L+5V J3-13
G L+5V J3-31
G L COM J3-14
G L COM J3-32
GUARD J3-4
GUARD J3-22
B
S1A (TENS)
U10A-D 100K
U4
+5V
U10 E-H 100K
U3
S1B (HUNDREDS)
CHASSIS J3-1
CHASSIS J3-19
C10 .025
C9 .025
C3 .025
C4 .025
HS0 J3-6
HS1 J3-24
HS2 J3-7
HS3 J3-25
CHS0 J3-10
CHS1 J3-28
CHS2 J3-11
CHS3 J3-29
C2 .025
C5 .025
C1 .025
C6 .025
CR1
A
K1
A/D COM J3-15
REF COM J3-33
LO J3-17
HI J3-35
TEMP SIG J3-16
+6.2V J3-30
P1-3
P1-2
P1-1
P1-4
P1-5
P2-2
LO
REF COM
A/D COM
HI
TEMP SIG
+6.2V
J4-15 A/D COM
J4-33 REF COM
J4-17 LO
J4-35 HI
J4-16 TEMP SIG
J4-30 +6.2V
P2-17
P2-18
P2-19
CHS0
CHS1

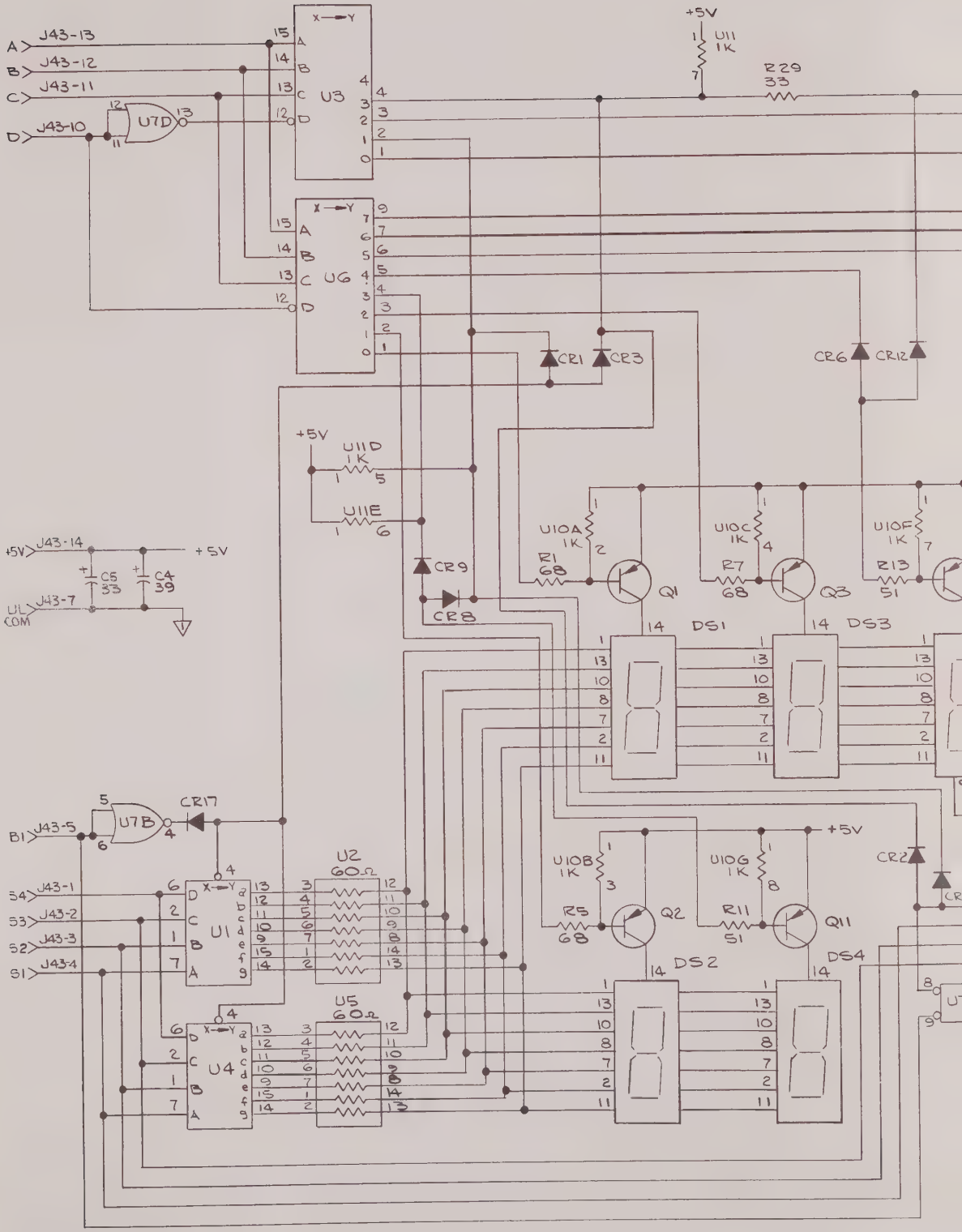


NOTES:
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. FOR ASSY DWG SEE 2201-4002.
3. ALL RESISTORS ARE 1/4 W,5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.14 AND Y32.2.
5. ▽2 DENOTES GUARDED LOGIC COMMON(G L COM).
6. ▽4 DENOTES A/D COMMON (A/D COM).
7. ▽5 DENOTES REFERENCE COMMON (REF COM).

IC	PIN NUMBER	
REF DES	G L +5V	G L COM
U1	14	7
U2	14	7
U3	16	8
U4	7,16	8
U5	1,16	8
U6	16	8
U7	16	8
U8	16	8
U9	1,16	8
U10	-	8
U11	14	7
U12	1,16	8

REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
C13 CR1 K1 L1 Q1	R1 S1 TP3 U12		

FIGURE 8-16. SCANNER EXTERNDER BANK SELECT PCB ASSEMBLY (2201A—1002)


A
B
C
D
J43-13
J43-12
J43-11
J43-10
U7D
U3
U6
+5V
U11
1K
R29
33
CR1
CR3
CR6
CR12
U11D
1K
U11E
1K
CR9
CR8
U10A
1K
R1
68
Q1
U10C
1K
R7
68
Q3
U10F
1K
R13
51
DS1
DS3
+5V
J43-14
+5V
C5
33
C4
39
UL
COM
J43-7
B1
J43-5
U7B
CR17
S4
J43-1
S3
J43-2
S2
J43-3
S1
J43-4
U1
U2
60Ω
U4
U5
60Ω
U10B
1K
R5
68
Q2
U10G
1K
R11
51
Q11
CR2
DS2
DS4

I.C REF DES	PIN NO.	
	+5V	UL COM
U1	16	8
U3	16	8
U4	16	8
U6	16	8
U7	14	7
U8	16	8

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ▽ DENOTES UNGUARDED LOGIC COMMON (UL COM).
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.14 AND Y32.2.
5. FOR ASSY DWG SEE 2240A-4008 FOR REF DES DWG SEE 2240A-1608.

REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
C5 CR21 DS9 Q11 R29	U8	C1,2,3 Q4 R4,6,8, 9,10,12, 14,15,16, 18,20,21, 22,24,26, 27,28	

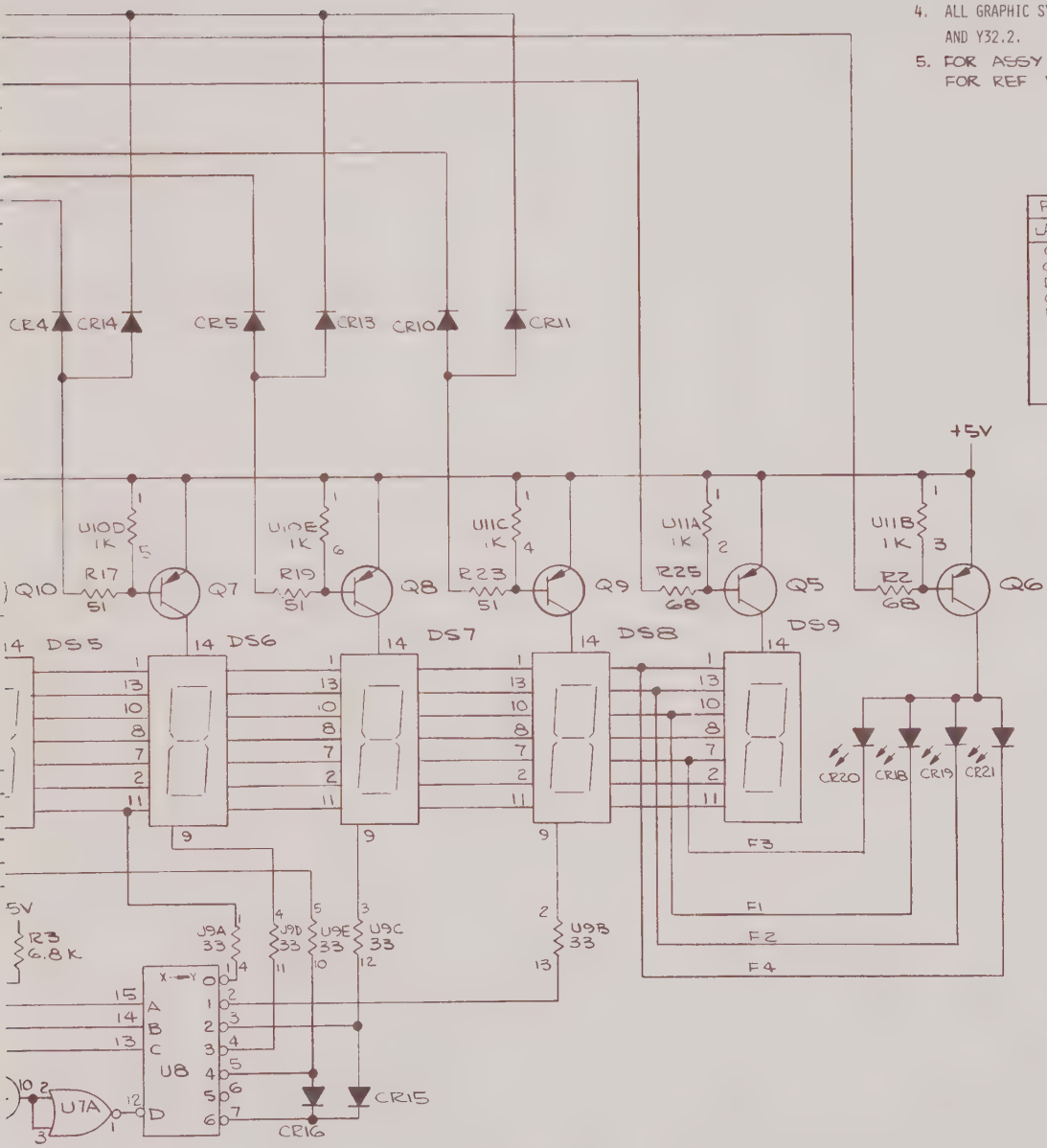
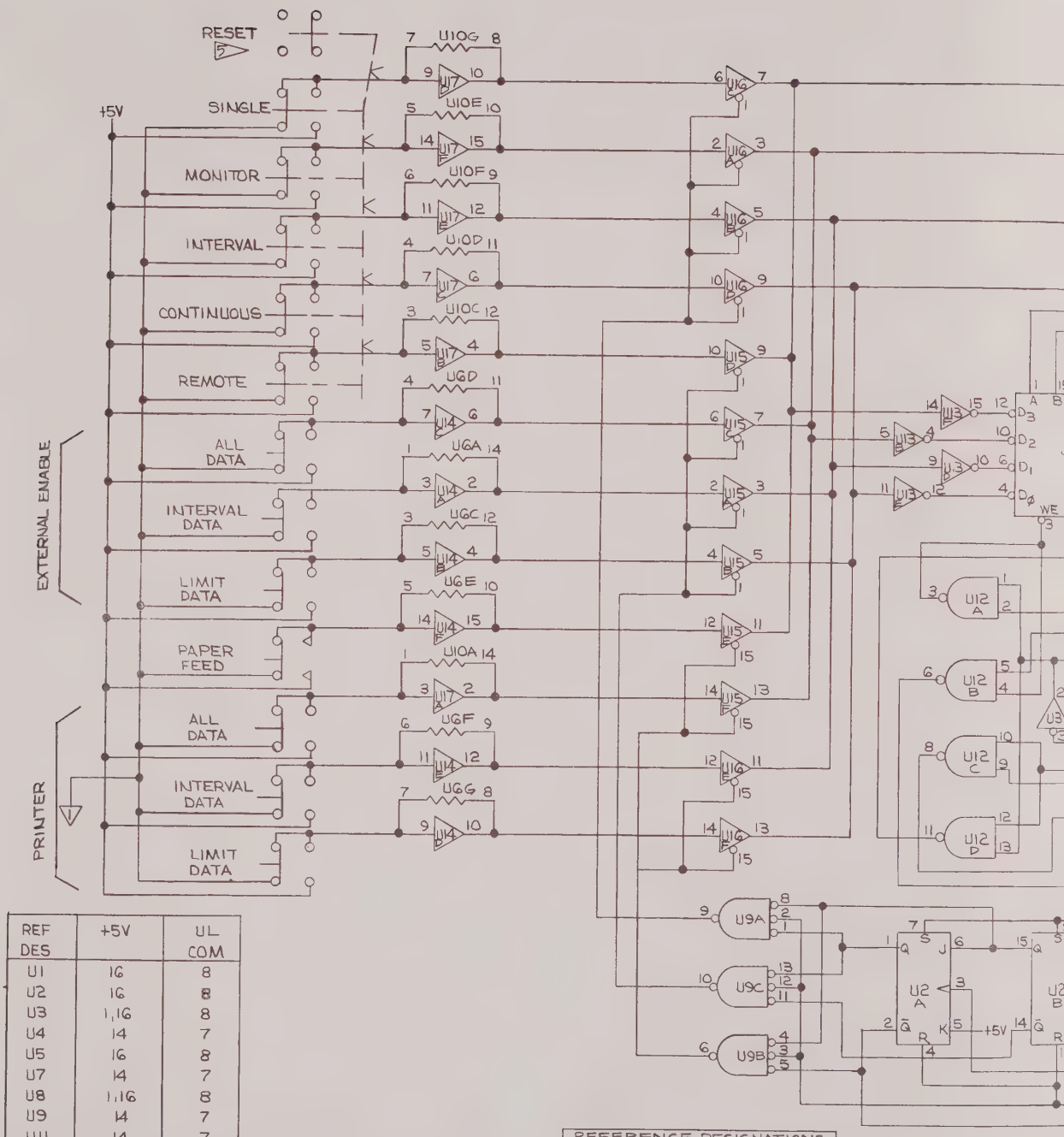


FIGURE 8-17. CHANNEL DISPLAY ASSEMBLY (2240A–1008)



REF DES	+5V	UL COM
U1	16	8
U2	16	8
U3	1,16	8
U4	14	7
U5	16	8
U7	14	7
U8	1,16	8
U9	14	7
U11	14	7
U12	14	7
U13	1,16	8
U14	1,16	8
U15	16	8
U16	16	8
U17	1,16	8
U18	14	7
U19	14	7

REFERENCE DESIGNATIONS

LAST USED		NOT USED	
C2 R1 U20			

NOTES:

1. FOR ASSEMBLY DWG SEE 2240A-4009.
2. ALL GRAPHIC SYMBOLS ARE IN ACCORDANCE WITH Y32.14 AND Y32.2.
3. ▽ DENOTES UNGUARDED COMMON (UL COM).
4. ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

5 "RESET" SWITCH SHOWN IN DEPRESSED POSITION. ALL OTHER SWITCHES SHOWN IN NONDEPRESSED POSITION.

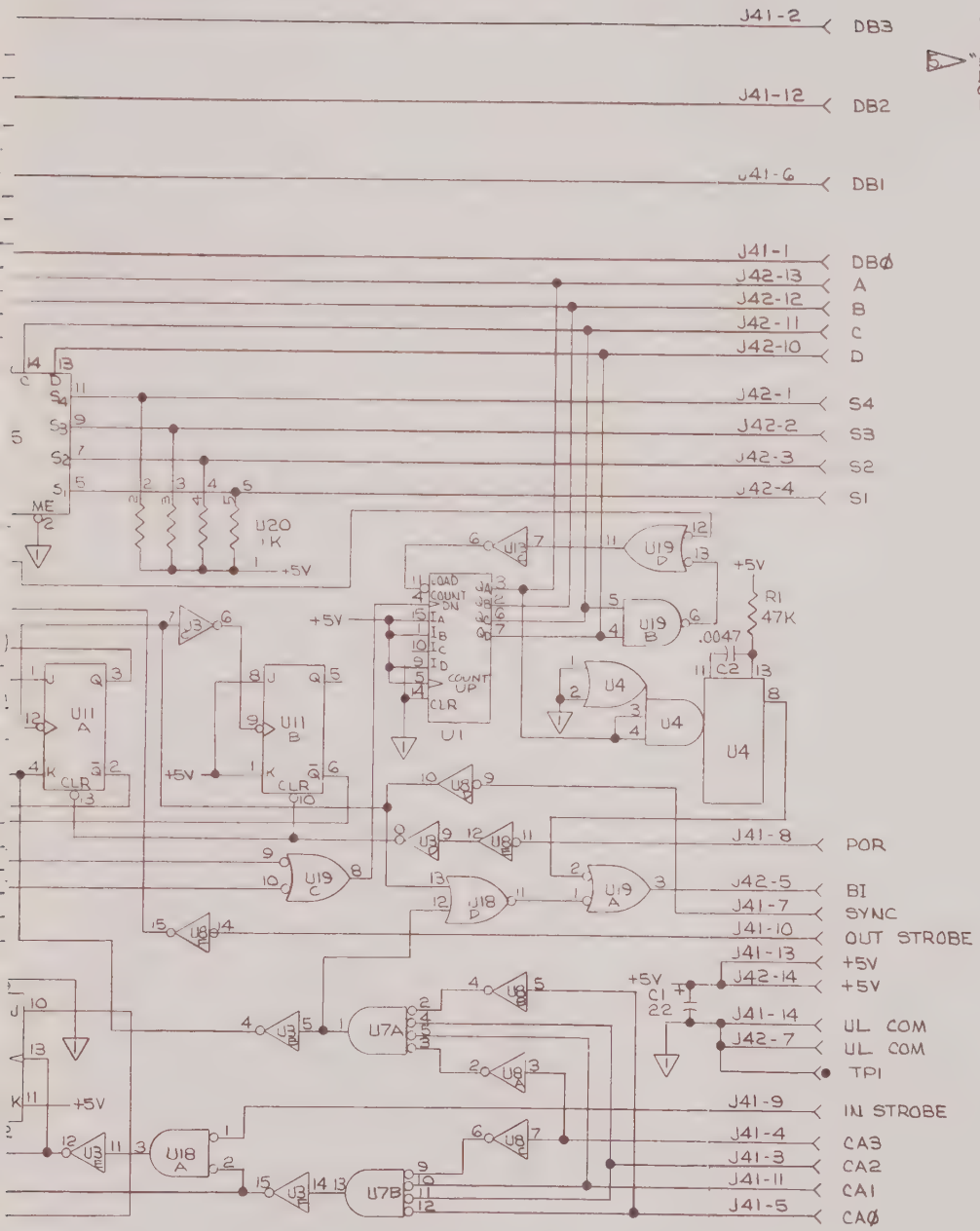
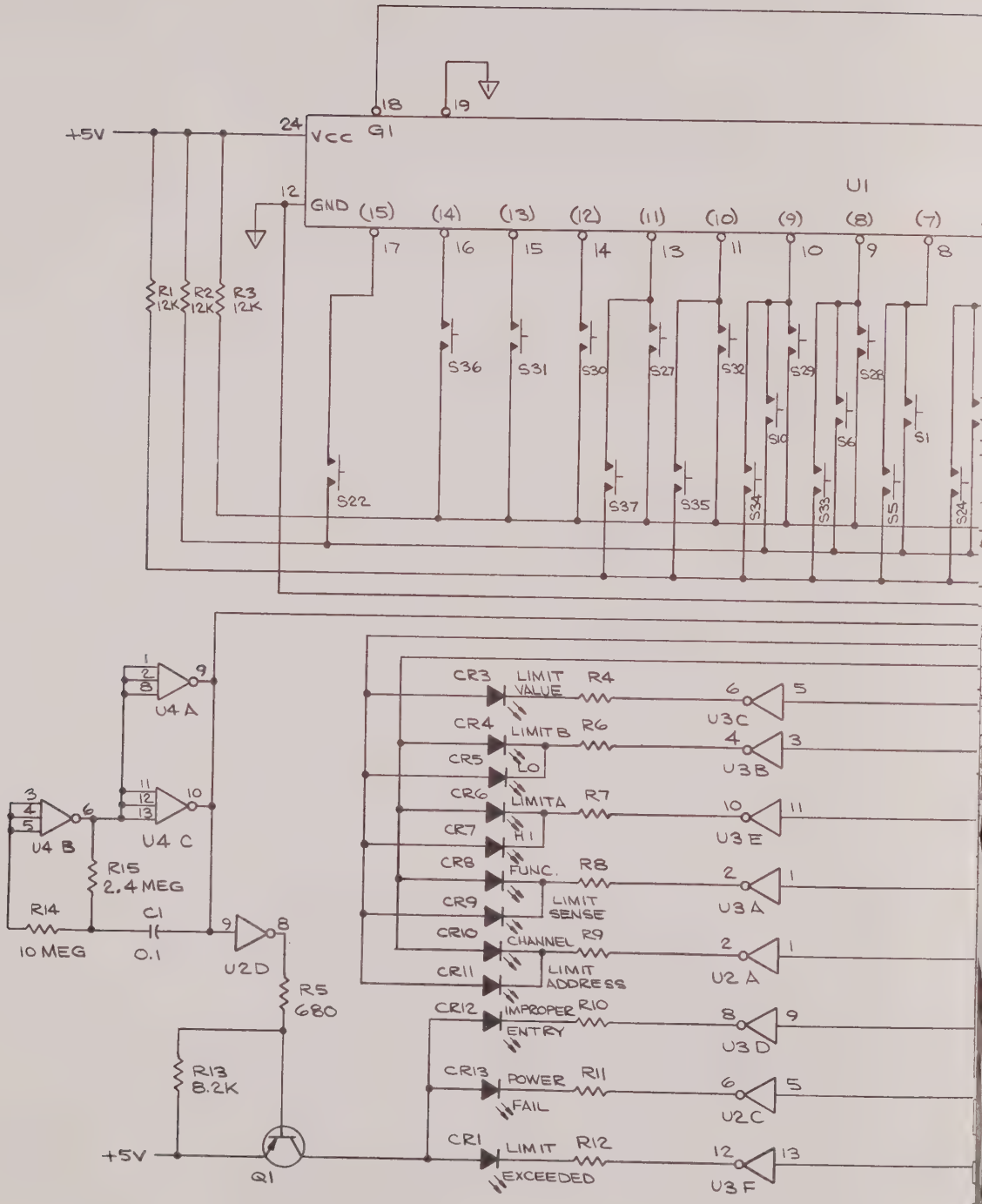
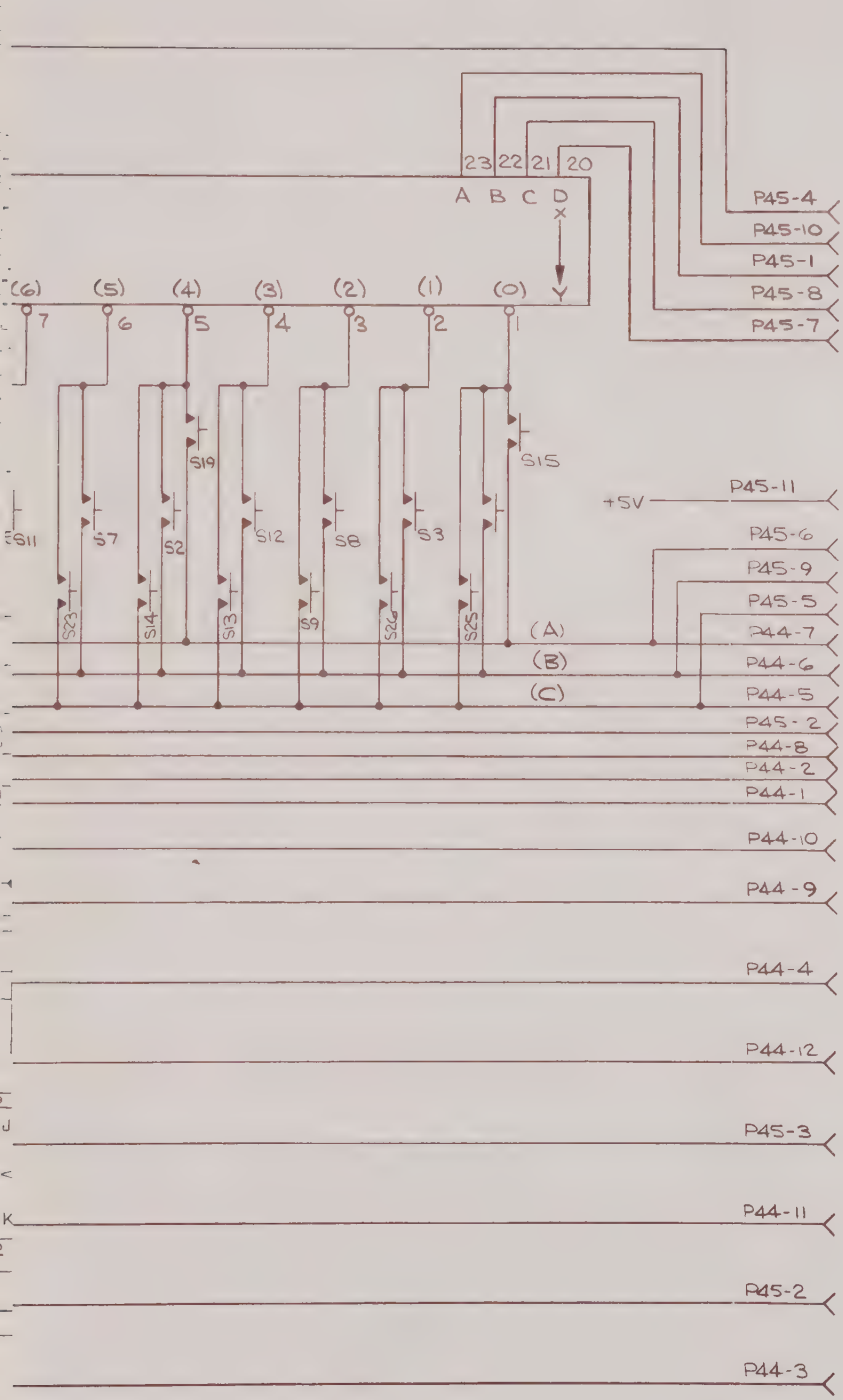


FIGURE 8-18. MODE SWITCH ASSEMBLY (2240A–1009)


+5V
24
VCC
18
19
G1
12
GND
U1
(15)
(14)
(13)
(12)
(11)
(10)
(9)
(8)
(7)
17
16
15
14
13
11
10
9
8
R1 12K
R2 12K
R3 12K
S22
S36
S31
S30
S27
S32
S29
S28
S10
S6
S1
S37
S35
S34
S33
S5
S24
U4 A
U4 B
U4 C
R15 2.4 MEG
R14 10 MEG
C1 0.1
U2D
R5 680
R13 8.2K
Q1
CR3 LIMIT VALUE R4
CR4 LIMIT B R6
CR5 LO
CR6 LIMIT A R7
CR7 HI
CR8 FUNC. R8
CR9 LIMIT SENSE
CR10 CHANNEL R9
CR11 LIMIT ADDRESS
CR12 IMPROPER ENTRY R10
CR13 POWER FAIL R11
CR1 LIMIT EXCEEDED R12
U3C
U3B
U3E
U3A
U2A
U3D
U2C
U3F



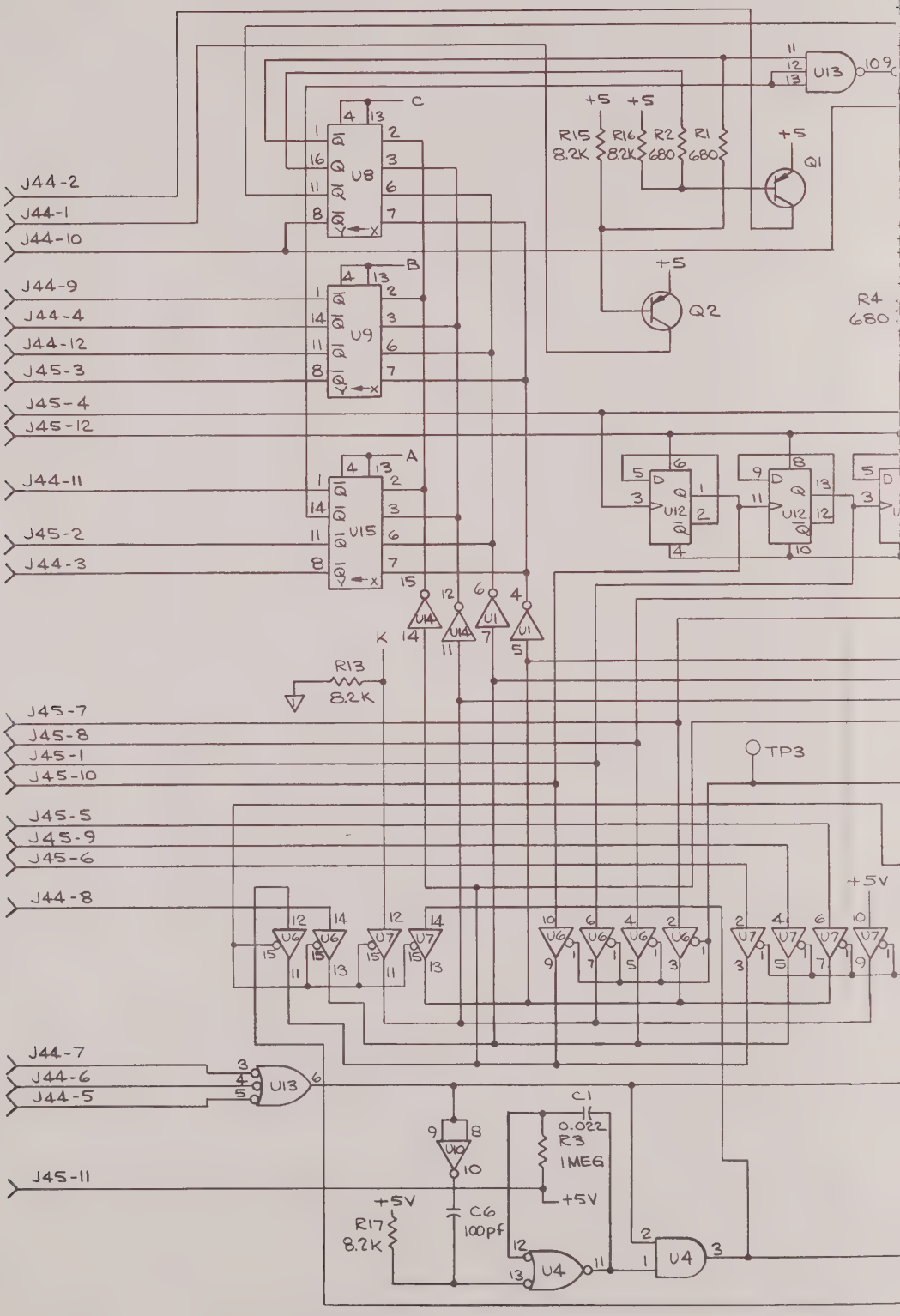
NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ▽ DENOTES UNGUARDED LOGIC COMMON (UL COM).
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.14 AND Y32.2.
5. FOR ASSY DWG. SEE 2240A-4011, FOR REF. DES. DWG. SEE 2240A-1611.

I.C. REF. DES.	PIN NO. +5V	PIN NO. UL COM
U1	24	12, 19
U2	14	7
U3	14	7
U4	14	7

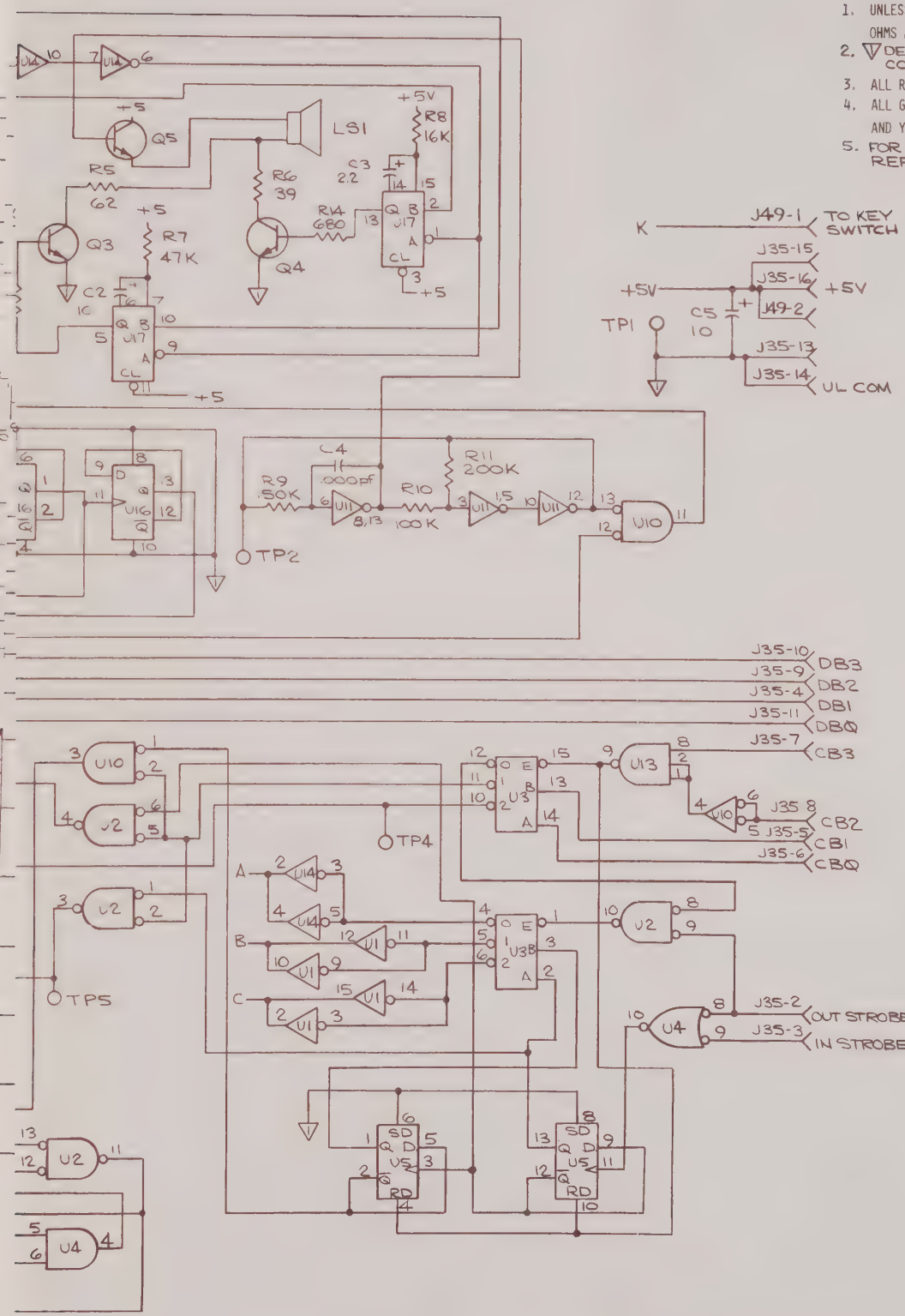
REFERENCE DESIGNATIONS LAST USED		NOT USED	
R15		CR2	
C1			
CR13			
Q1			
U5			

FIGURE 8-19. KEYBOARD SWITCH ASSEMBLY (2240A–1011)


J44-2
J44-1
J44-10
J44-9
J44-4
J44-12
J45-3
J45-4
J45-12
J44-11
J45-2
J44-3
J45-7
J45-8
J45-1
J45-10
J45-5
J45-9
J45-6
J44-8
J44-7
J44-6
J44-5
J45-11
U8
U9
U15
U13
U14
U1
U12
U6
U7
U4
U5
R15 8.2K
R16 8.2K
R2 680
R1 680
R4 680
R13 8.2K
R17 8.2K
R3 1MEG
C1 0.022
C6 100pf
Q1
Q2
+5
+5V
TP3

NOTES:

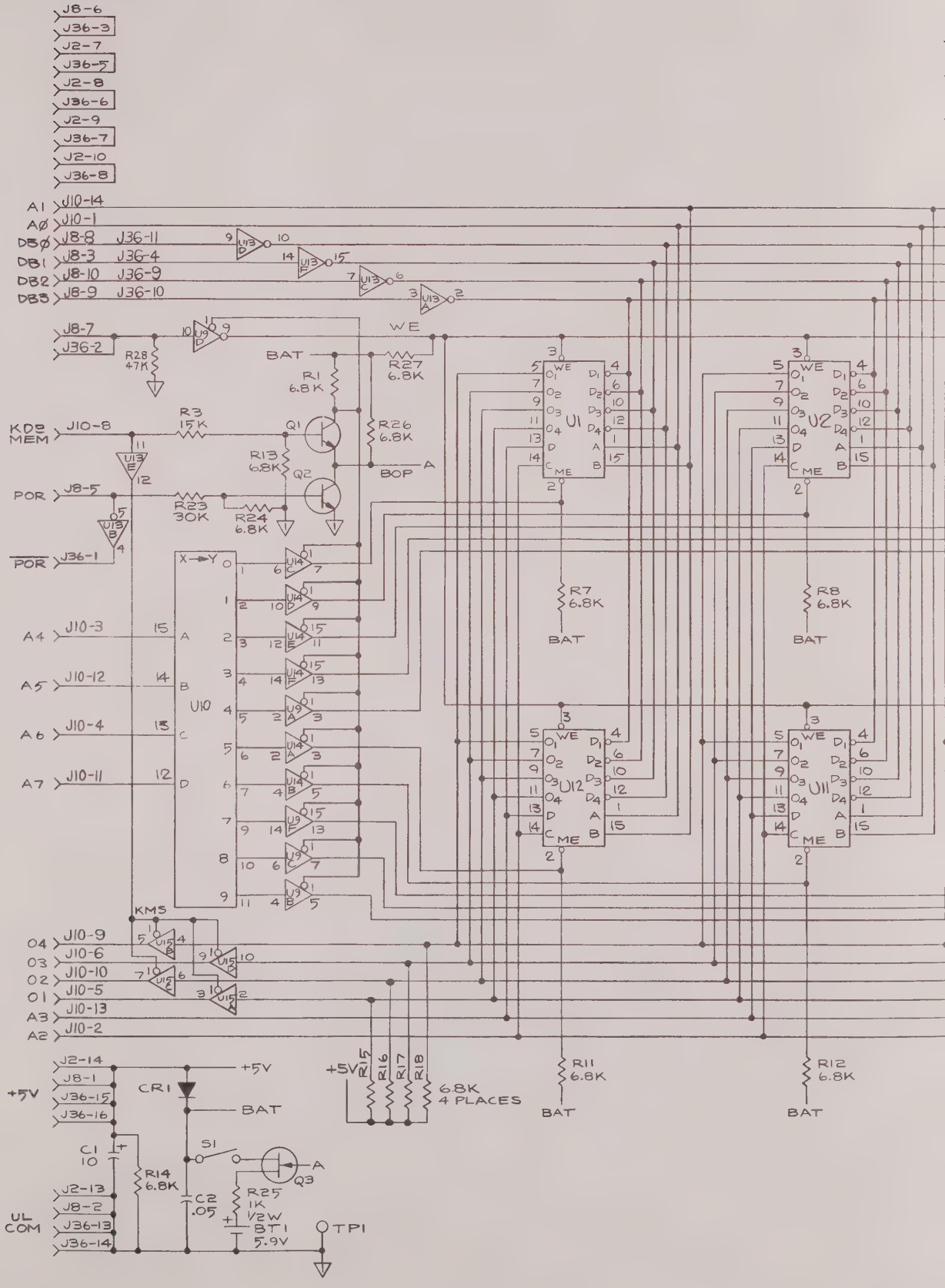
1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. ▽ DENOTES UNGUARDED LOGIC COMMON (UL COM).
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.14 AND Y32.2.
5. FOR ASSY. DWG. SEE 2240A-4012. FOR REF. DES. DWG. SEE 2240A-1612.



IC. REF. DES.	PIN NO. +5V	PIN NO. UL COM
U1	1,16	8
U2	14	7
U3	16	8
U4	14	7
U5	14	6,8
U6	16	8
U7	6,16	8
U8	5	12
U9	5	12
U10	14	7
U11	2,11,14	4,7,9
U12	14	7
U13	14	7
U14	1,16	8
U15	5	12
U16	14	7
U17	16	8.

REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
R17		R12	
C6			
Q5			
U17			
LS1			
TP5			

FIGURE 8-20. KEYBOARD LOGIC PCB ASSEMBLY (2240A–1012)


J8-6
J36-3
J2-7
J36-5
J2-8
J36-6
J2-9
J36-7
J2-10
J36-8
A1
A0
DB0
DB1
DB2
DB3
J10-14
J10-1
J8-8
J36-11
J8-3
J36-4
J8-10
J36-9
J8-9
J36-10
U13
J8-7
J36-2
R28
47K
WE
BAT
R1
6.8K
R27
6.8K
R3
15K
KDB
MEM
J10-8
Q1
R26
6.8K
R13
6.8K
Q2
BOP
A
POR
J8-5
R23
30K
R24
6.8K
POR
J36-1
U14
U9
X→Y
U10
A4
J10-3
A5
J10-12
A6
J10-4
A7
J10-11
U1
U2
U12
U11
R7
6.8K
R8
6.8K
KMS
U15
04
J10-9
03
J10-6
02
J10-10
01
J10-5
A3
J10-13
A2
J10-2
+5V
R15
R16
R17
R18
6.8K
4 PLACES
R11
6.8K
R12
6.8K
J2-14
J8-1
J36-15
J36-16
CR1
S1
Q3
C1
10
R14
6.8K
C2
.05
R25
1K
1/2W
BT1
5.9V
TP1
J2-13
J8-2
J36-13
J36-14
UL
COM

REFERENCE DESIGNATIONS			
LAST USED		NOT USED	
BT1 C2 CR1 Q3 R28 S1	U15		

NOTES:

1. UNLESS OTHERWISE SPECIFIED ALL RESISTANCES ARE IN OHMS AND ALL CAPACITANCES ARE IN MICROFARADS.
2. FOR ASSY. DWG. SEE 2240A-4013. FOR REF. DES. DWG. SEE 2240A-1613.
3. ALL RESISTORS ARE 1/4W, 5% UNLESS OTHERWISE NOTED.
4. ALL GRAPHIC SYMBOLS IN ACCORDANCE WITH ANSI Y32.14 AND Y32.2.
5. ▽ DENOTES UNGUARDED LOGIC COMMON (UL COM).

I.C. REF. DES.	PIN NUMBERS		
	+5V	BAT	UL COM
U1	—	16	8
U2	—	16	8
U3	—	16	8
U4	—	16	8
U5	—	16	8
U6	—	16	8
U7	—	16	8
U8	—	16	8
U9	—	16	8
U10	16	—	8
U11	—	16	8
U12	—	16	8
U13	1,16	—	8
U14	—	16	8
U15	16	—	8

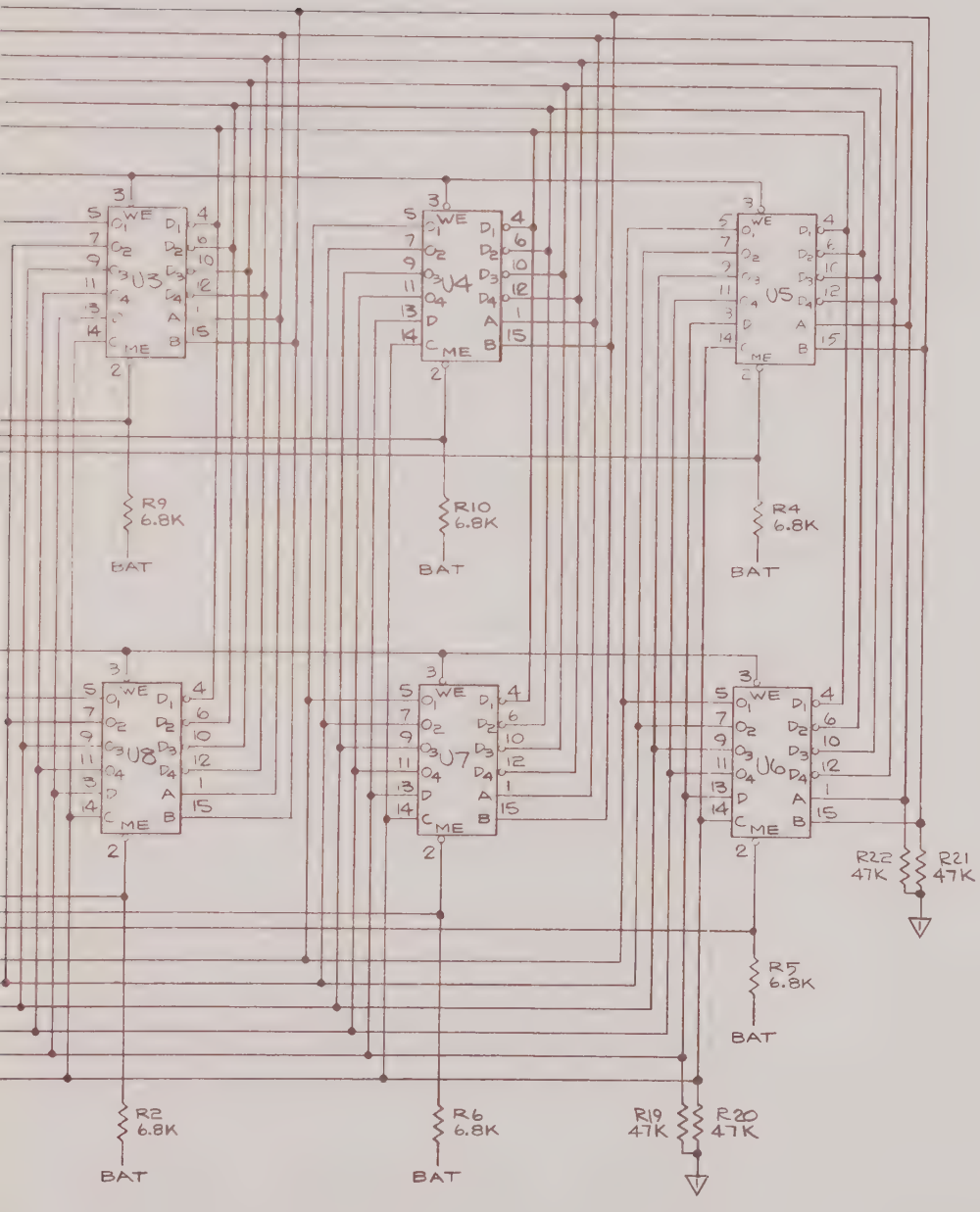
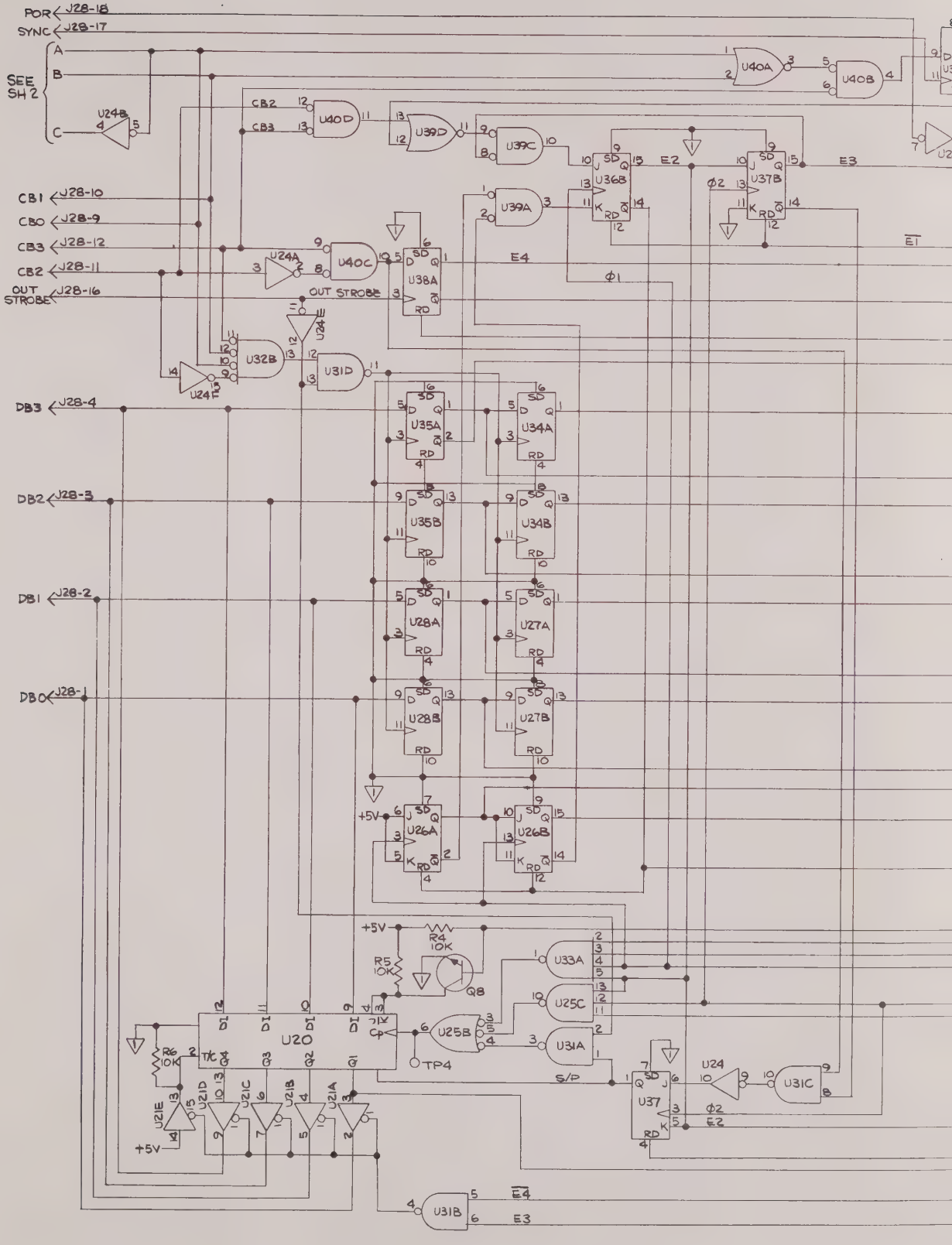
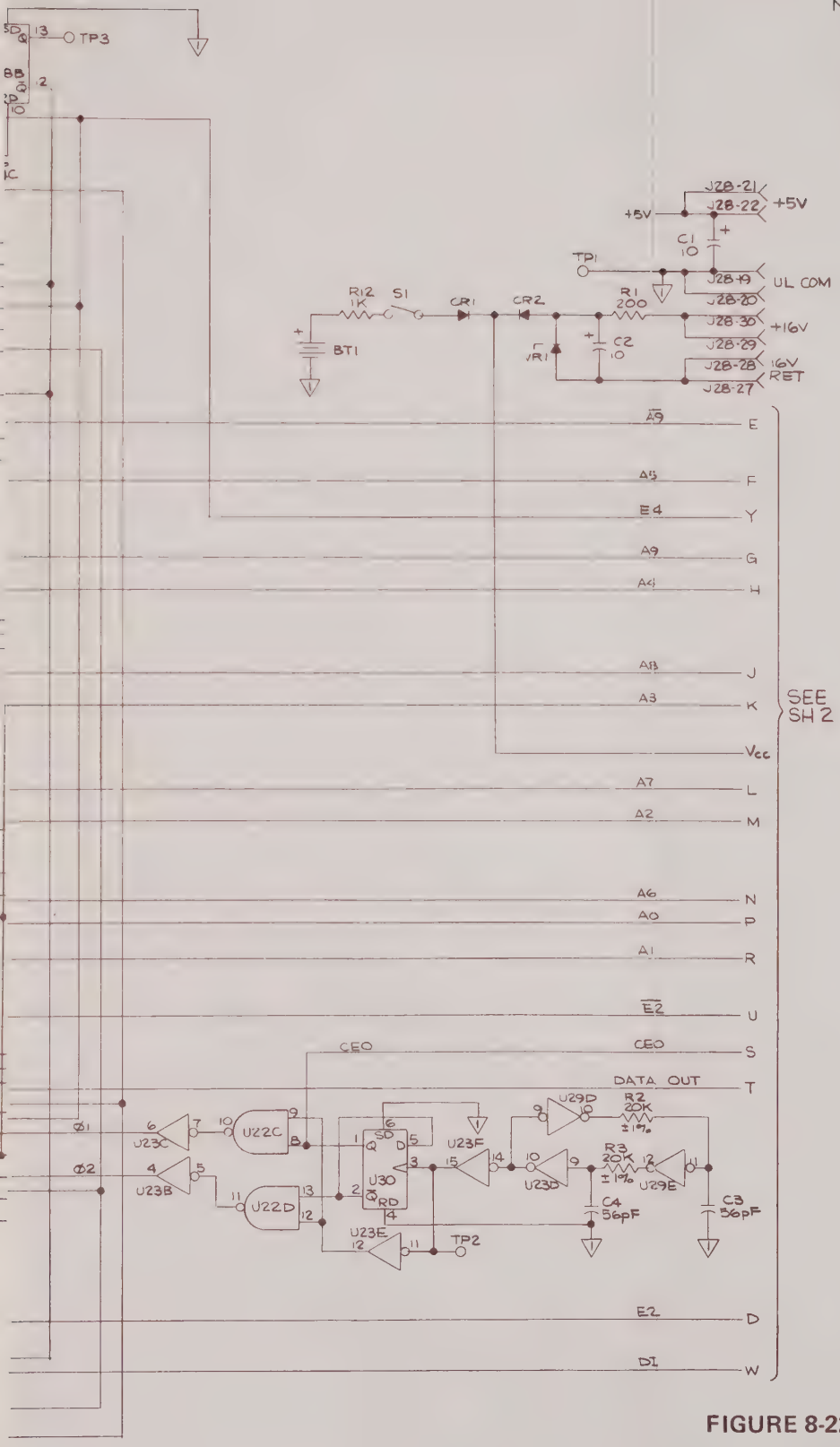


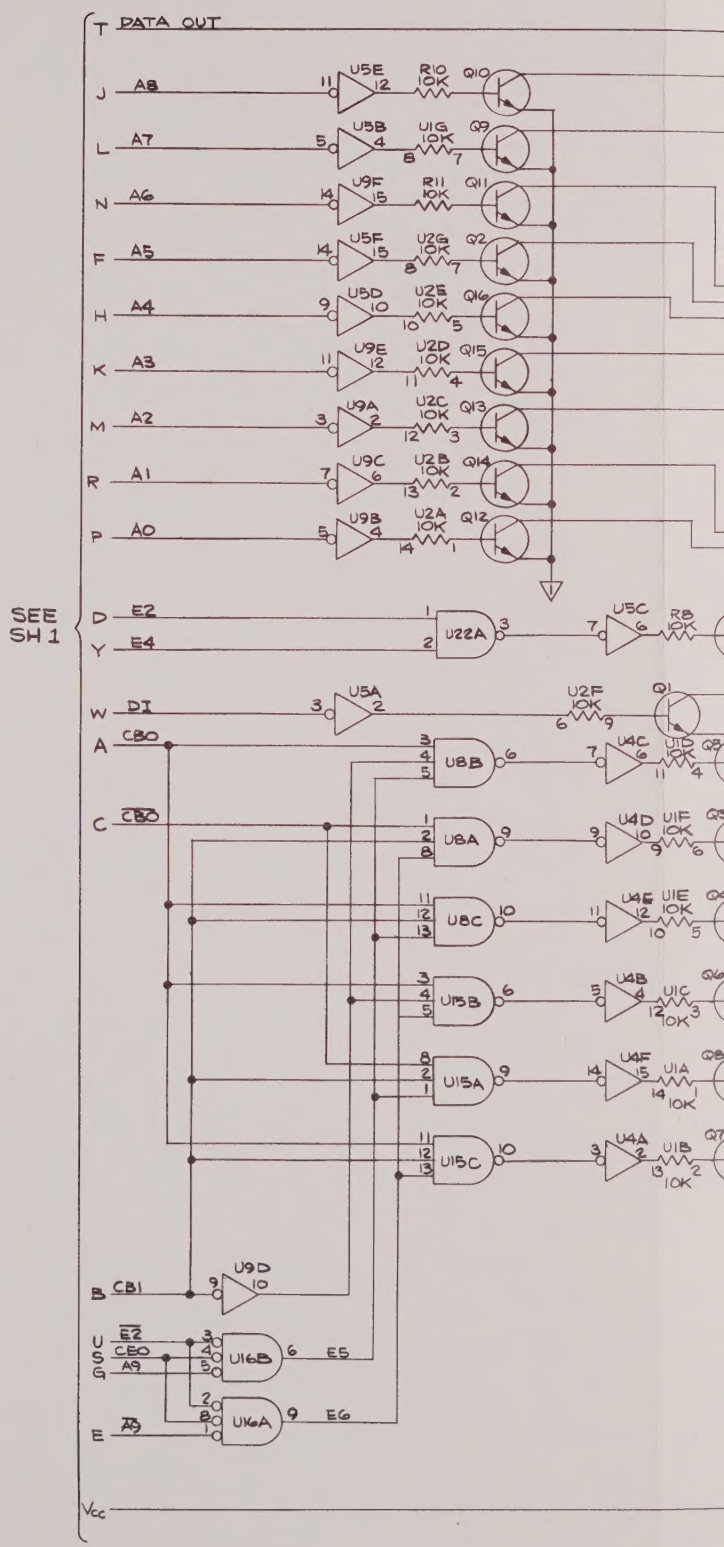
FIGURE 8-21. KEYBOARD MEMORY PCB ASSEMBLY (2240A–1013)


POR J28-18
SYNC J28-17
SEE SH 2
A
B
C
U24B
U40A
U40B
U40D
U39D
U39C
U36B
U37B
E2
E3
CB1 J28-10
CB0 J28-9
CB3 J28-12
CB2 J28-11
OUT STROBE J28-16
U39A
U24A
U40C
U38A
E4
Φ1
Φ2
ET
OUT STROBE
U24
U32B
U31D
DB3 J28-4
DB2 J28-3
DB1 J28-2
DB0 J28-1
U35A
U34A
U35B
U34B
U28A
U27A
U28B
U27B
U26A
U26B
+5V
R4 10K
R5 10K
R6 10K
Q8
U33A
U25C
U31A
U25B
U20
TP4
S/P
U37
U31C
U21E
U21D
U21C
U21B
U21A
U31B
E4
E3



IC REF DES	PIN NUMBER +5V	UL COM	Vcc
U3	16	8	
U4	1,16	8	
U5	1,16	8	
U8	14	7	
U9	1,16	8	
U10		8	16
U11		8	16
U12		8	16
U15	14	7	
U16	14	7	
U17		8	16
U18		8	16
U19		8	16
U20	16	8	
U21	16	8	
U22	14	8	
U23	1,16	8	
U24	1,16	8	
U25	14	7	
U26	16	8	
U27	14	7	
U28	14	7	
U29	1,16	8	
U30	14	7	
U31	14	7	
U32	14	7	
U33	14	7	
U34	14	7	
U35	14	7	
U36	16	8	
U37	16	8	
U38	14	7	
U39	14	7	
U40	14	7	

FIGURE 8-22. (1 of 2) RANGE AND FREQUENCY MEMORY PCB ASSEMBLY (2240A–1032)


T DATA OUT
J A8
L A7
N A6
F A5
H A4
K A3
M A2
R A1
P A0
U5E
U5B
U9F
U5F
U5D
U9E
U9A
U9C
U9B
R10 10K
U1G 10K
R11 10K
U2G 10K
U2E 10K
U2D 10K
U2C 10K
U2B 10K
U2A 10K
Q10
Q9
Q11
Q2
Q16
Q15
Q13
Q14
Q12
SEE SH 1
D E2
Y E4
U22A
U5C
RB 10K
W DI
U5A
U2F 10K
Q1
A CB0
C CB0
U8B
U8A
U8C
U15B
U15A
U15C
U4C
U4D
U4E
U4B
U4F
U4A
U1E 10K
U1C 10K
U1A 10K
U1B 10K
B CB1
U9D
U E2
S CE0
G A9
U16B
E5
E A9
U16A
E6
Vcc

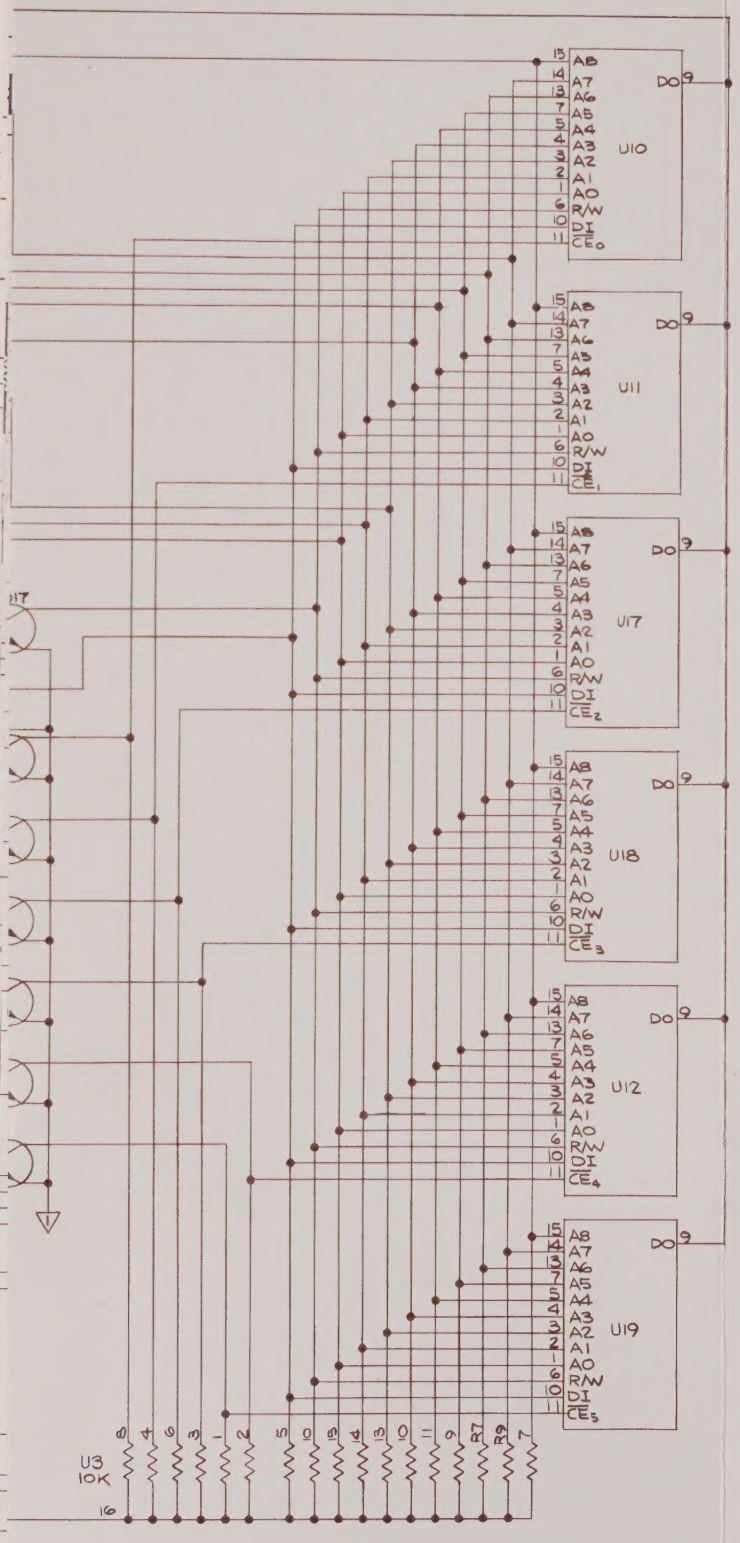


FIGURE 8-22. (2 of 2)RANGE AND FREQUENCY MEMORY PCB ASSEMBLY (2240A–1032)

FLUKE®

CERTIFICATE of CALIBRATION

MODEL 2240A SERIAL NO. 0510004 DATE NOV 29 1976

The John Fluke Mfg. Co., Inc. certifies that the above listed instrument meets or exceeds all published specifications and has been calibrated using standards whose accuracies are traceable to the National Bureau of Standards within the limitations of the Bureau's Calibration services, or have been derived from accepted values of natural physical constants, or have been derived by the ratio type of self-calibration techniques.

Applicable NBS Test Report Numbers:

DC Voltage – 213385
AC Voltage – 807675 & 212126
Resistance – 214691
Frequency – WWVB

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John F. Holloran
STANDARDS ENGINEER

Anthony J. Petroske Jr.
MANAGER, QUALITY ASSURANCE

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